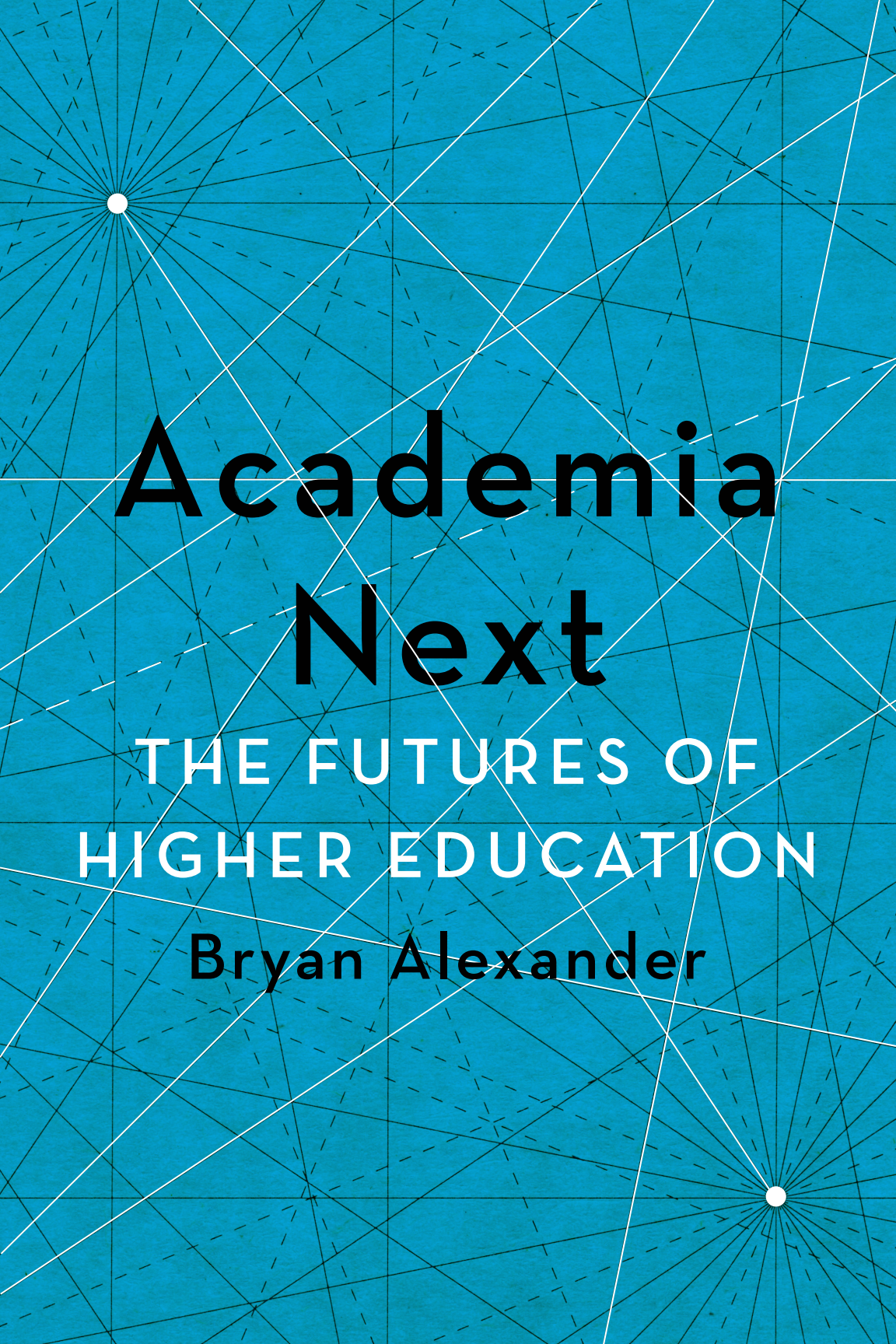
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THE FUTURES OF HIGHER EDUCATION
Bryan Alexander

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Academia Next

The Futures of Higher Education

Bryan Alexander

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To all adjunct faculty, who do more than anyone,
with less than anyone,
to build the future of higher education

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These and others are the source of this book's intelligence and reflection. All errors and lapses are solely my own.

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Academia Next

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Introduction

> The biggest threat those of us working in colleges and universities face isn't video lectures or online tests. It's the fact that we live in institutions perfectly adapted to an environment that no longer exists.
>
> Clay Shirky

What is happening to American higher education? How will it change in the years to come?

The future of higher education is a popular topic in news media, prompting headlines and reports pitched to various degrees of concern. We frequently read, watch, or listen to stories of skyrocketing tuition, epochal levels of debt, and doomed or culturally destructive students. Grim stories of layoffs and campus closures cross nearly all forms of news media, from print newspapers to podcasts.

Naturally, the topic is one that many of us involved in higher education passionately pursue. Would-be college students wonder about debt and careers, as do their families. Professors ponder the fate of their campuses and their own positions. Staff and administrators strategize in a time of increasing anxiety and doubt.

For years, educators, analysts, policymakers, business leaders, and other interested people have publicly proclaimed or investigated the future of colleges and universities. They have imagined new forms of learning and called for innovative programs, centers, and campuses. Some have wielded government power to reshape academia, while

others have reformed institutions directly or booted up new enterprises from scratch.

At times the future of colleges and universities seems to be in doubt. Over the past decade student loan debt has ballooned beyond $1 trillion while tuitions have soared. Campuses have closed departments, reduced faculty, merged, or even shut down. Technological innovations offer new opportunities for learning while threatening the business models of established campuses. Total undergraduate enrollments have dropped for nearly a decade. Anxieties abound about campus politics and the value of degrees.

And yet American universities remain sought after and respected worldwide. Students travel to these campuses from all continents except Antarctica, and we send researchers and students there anyway. In a sense higher education is one of America's most brilliant and rewarding exports. Faculty members continue to publish discoveries that expand human knowledge and enrich lives. College sports remain crucial cultural touchstones and, occasionally, profitable businesses. More Americans than ever before have had at least some postsecondary education, while the national consensus is that even more people should attend college.

We seem, in short, to be entering an uncertain and chaotic period for colleges and universities. Possibilities of excellence and extinction stand in conflict. Faculty, staff, and students develop some of the same technologies that return to challenge the survival of academia as we know it. Stories of abuse, corruption, inequality, and violence appear in the news alongside accounts of personal growth, social benefit, intellectual exploration, and human possibility. As of this writing, there is no consensus as to where American higher education is headed.

The desire to guide education's next decades has grown in recent years. The future has also become darker and more urgent, especially after the 2008 financial disaster. That economic spasm sent many more people into colleges and universities to improve their chances of getting scarce jobs, while gutting endowments and stressing cam-

pus finances to their limits. Escalating debt drew more scrutiny as family budgets tightened, even while interest rates plummeted.

The recovery that followed was halting and uneven, and it is still not complete in 2019. In the meantime student debt has soared and enrollments decreased. More attention—but not nearly enough—has been paid to the fact that most professors are part-timers, hired and fired at will and far too often working in poverty. Meanwhile, many Republicans and even a majority of Democrats think higher education is heading down the wrong path. The national mood for education reform has persisted, even across states and political parties.[1]

This past decade has also seen the continued development and expansion of the digital revolution. In one way, we may be living in the greatest time in human history for learners, but it has been a challenging time for academic institutions. Thanks to the creation and sharing of digital content through the Internet, would-be learners have access to more materials and experts than ever before. Encyclopedia entries, videos, audio lectures, personal blogs written by experts, courses, textbooks, games, galleries, and entire libraries await the inquiring mind. Yet this educational bonanza has not translated into vibrancy for postsecondary institutions. Instead we speak of higher education as being in crisis, under threat, or a bubble about to burst. Meanwhile, we are also increasingly concerned about Silicon Valley's many misdeeds, from privacy violations to cynical business models, endless data breaches, and collateral damage affecting numerous industries and perhaps even democracy itself.

This book examines the future of American higher education in the age of information plentitude and sustainability stress. It offers forecasts for how these vital institutions are changing over the next generation. The basis for this work lies in the present, as I examine the real world of colleges and universities and the contexts that shape them for clues as to the emerging future. I identify drivers of change, based on objective evidence, and then proceed to informed speculation about what trends those colleges and universities will craft later in the twenty-first century.

Strong and radical challenges lie ahead for colleges and universities. We will likely see more campuses shrink, merge, or close. Higher education's reputation could continue to decline. Many institutions will choose to reinvent themselves, a process fraught with stresses, human suffering, and failure. Demographics and economics appear poised to drive massive changes to campuses known for their steadfast identities. Multiple political pressures can whipsaw administrators, faculty, and students. Rapid scientific and technological innovation threatens to reboot nearly every aspect of college life, while driving deeper changes through human civilization itself.

It is only by taking these trends seriously that colleges and universities can improve their chances of survival. Institutional flourishing now requires a future-oriented mind-set. We need the practice and imagination that strategic foresight provides, along with a willingness to thoughtfully experiment, in order to shoot the rapids that loom before us. Otherwise American higher education confronts chronically crisis-oriented budgeting, shrinkage, decline, cuts to operations and staff, program reductions, and merged or closed institutions.

To seriously explore the future of American higher education, it is vital to consider the sector in its entirety. This may seem self-evident, especially to an outside observer, but such examination is actually rarely done, despite—or because of—the sheer size of the sector. There are roughly 4,300 colleges and universities in the United States (or closer to 6,500, depending on whether one counts certain for-profit institutions, and how many survive at a given time).[2] Many discussions of academia focus on one sector within the whole, or even on a small group of campuses. Such work is useful on its own terms but can easily miss the bigger picture. A casual glance at books and articles published about higher education over the past twenty years reveals various claims about all colleges and universities, but many of them speak solely from the perspective of several research universities or a handful of liberal arts campuses. Community colleges, which educate more people than any other segment of higher education, are

rarely mentioned, especially in discussions of sky-high tuition, free speech on campus, or lavish residence halls. For-profit education, which boomed in the 1990s and 2000s, is even harder to find represented. Geographically, northeastern campuses often receive the lion's share of attention, even as the traditional-age population there declines and despite the rich, nationwide panoply of higher learning. Historically black colleges and universities are almost invisible.

This book considers the full range of postsecondary education. It is an approach partially based on the unusual trajectory of my career. A three-time graduate from a major public research university (Michigan), I taught at a small liberal art campus (Centenary College of Louisiana) and went on to teach at a private Jesuit research university (Georgetown). In between the last two positions I worked for a nonprofit (National Institute of Technology in Liberal Education) that connected hundreds of small colleges across the country, many considered liberal arts institutions. Some are religious schools, other secular; some focus on teaching while others zero in on research, and still others combine the two. Some are local in their recruiting and outreach focus, while others are regional, national, or international in scope. Starting around 2010, I began working as well with community colleges, for-profits, state universities, state systems, and military universities. Several of these exist completely online, while others actively resist the digital world, and many occupy a position in between. I have also worked with academia-focused think tanks, professional organizations, government agencies, and businesses, not to mention public libraries and library associations. Many of these entities exist in the United States, while some are in Africa, Asia, Australia, Europe, and Latin America. At every step of the way I have talked with people occupying all positions in these organizations: presidents, trustees, librarians, students, grants officers, security guards, state legislators, lawyers, chief financial officers, and more. All of these encounters have given me an unusual perspective on American higher education, and I try to echo that viewpoint in the chapters that follow.

I also find it useful to consider colleges and universities strategically. By this I mean, first, to model the institution through addressing its multiple internal levels and functions, from teaching to admissions, classrooms to libraries. Focusing on a single profession or campus function can provide depth to an analysis, but it risks losing a sense of an institution as a whole. Second, a campus-wide approach lets us consider the choices an institution faces, choices that affect all offices and professions.

This campus- and sector-wide approach also informed the research and professional practices that underpin the present book. I must refer again to my unusual career. For three years I have run a weekly videoconference about education's future. Unlike most webinars, the Future Trends Forum consists entirely of conversations between me, guests, and hundreds of interested people from around the world. Guests and participants have included professors, librarians, technologists, college presidents, students, start-up founders, critics of start-ups, journalists, government officials, inventors, and people working in nonprofits and associations. They have been based in research universities, religious schools, community colleges, military academies, state universities, liberal arts colleges, and art schools, not to mention museums, archives, and libraries. Their cumulative experiences and thoughts have strongly shaped this book. That population along with thousands of others who read the Future Trends in Technology and Education report have contributed news stories, scholarly articles, and books from across a vast range of intellectual domains, all of which fed into this volume. Moreover, as I have traveled to speak and consult, even virtually, I have received a lot of feedback (and push-back) on the ideas they grew into this book's arguments. I hope that the institutional and intellectual variety that these people have generously shared is manifest in the pages that follow.

* * *

The first part of this book examines recent history for clues to the future. Each chapter addresses a different segment or stratum of ac-

ademia, identifying the most important trend lines. Taken together, the first six chapters may be considered a kind of snapshot of our time, a partial documentation of American higher education and its social, economic, and technological contexts in the early twenty-first century.

I begin chapter 2 with a discussion of forecasting methods. The first method is trend analysis, the identification of influential change drivers in the present and their extrapolation into the future. These change drivers occupy the first half of the book. The second method is the creation of scenarios, narratives of possible futures based on the outcomes of one or several trends. These scenarios appear in the book's second half.

Chapter 3 explores the world of education in detail, including enrollment patterns, college sports, alternative certification, and the growth of higher education's international market. Chapter 4 turns to two of the major contexts reshaping colleges and universities: demographics and macroeconomic forces. Aging populations that are unevenly distributed and rising income inequality are central to this section. Chapter 5 investigates developments in technology that can directly or indirectly reshape education. It covers a wide terrain, including automation, 3D printing, the ramifying device ecosystem, virtual/augmented/mixed reality, and social media. Chapter 6 explores trends stemming from the intersection of education and technology, such as learning management systems, the digital humanities, and automation on campus.

Part II uses a different methodology to offer scenarios of possible futures based on selected trends exerting a determining force. Chapter 7 imagines higher education after it has peaked, around the year 2012, and has moved downslope into institutional and sectoral decline. Chapter 8 contrasts this decline by envisioning an America where health care has become the nation's leading industry, and how colleges and universities have been affected as a result. In chapter 9 we see academia enjoying the benefits and coping with the challenges of an open paradigm that has triumphed and remade the information

world. Chapter 10 takes a more optimistic tone still, forecasting a period of cultural creativity and its impact on postsecondary learning. Chapters 11 and 12 depict even stronger (or stranger) technological transformation as institutions delve deeply into augmented and mixed reality or automation. Chapter 13 imagines the reverse, a campus that energetically refuses twenty-first-century technology in order to relive what it sees as a better way of teaching, researching, and learning.

Part III takes us further into the future and then straight back to the present. With even more caution and trepidation we explore the world beyond the year 2040 in chapter 14, carefully trying to imagine possible academic entities. Chapter 15 then hauls the reader back to their present day, offering methodological and strategic ways of applying this futures work to our current colleges and universities. It focuses on our agency in addressing the future, helping us think through how we can act upon and intervene in the emerging nature of higher education.

A note on how to use this book: my intention is, first, to spark informed conversations. I hope that readers react and offer their own thoughts about where higher education may be headed. The chapters that follow cover a wide range of intellectual domains and practical problems. Many are challenging in themselves, and my assessments may appear to be incorrect. Trends can veer in wild directions, dropping out or accelerating. See where you think they might lead. Please push back, join in, or otherwise reflect out loud so that the general conversation becomes richer and more rewarding.

I want readers to feel some agency as they progress through this text. The accumulation of trends, metatrends, and scenarios may appear daunting over time, giving a sense of a future that's inevitable or otherwise beyond human influence. Some may come to this book with a sense of fatalism or distrust of academia's ability to change. Instead, please read with an openness to possibility; nothing here is written in stone. The future of academia is one we build together. May these chapters inspire each of you to take steps in shaping the best colleges and universities.

Before proceeding, we should set forth some limitations around the current project. To begin, this book focuses primarily on American higher education. Primary and secondary school worlds are rich and vital, but owing to space limitations they can only be touched on here insofar as they directly shape postsecondary institutions. (I regret this omission, as I sat on two school boards while writing this book.) We exclude corporate training for similar reasons. Both that field and K–12 deserve their own futures work.

Similarly, the vast world of global higher education beyond the United States appears only through a handful of trends, again for reasons of scope. I refer to the developing global higher education market and the increasingly globalized world of research insofar as they affect the American system. The full span of civilization-wide postsecondary learning would benefit from futures work as well. I hope to contribute to that work at a later date, either on my own or, better yet, in collaboration with an international team.

A third caveat concerns time. The present volume is largely limited to exploring the next decade and a half, aiming at a period ending roughly 2033–35. Only chapter 14 exceeds that remit and does so with a great deal of throat clearing, hedging, and trepidation, partly because of the weight of the trend method, which is best, in my estimate, at near-term and midterm futures work. There are also possibly chaotic changes settling in as we pass the century's first third. Demographic, political, ecological, and especially technological developments that we can grasp now offer the possibility of a "VUCA" era, one marked by unusually high *v*olatility, *u*ncertainty, *c*omplexity, and *a*mbiguity. We can speculate and think through that time, but it requires a different intellectual armature than the one deployed in the present work. Again, this may become the subject of forthcoming research.

A fourth limitation is that of genre. This book is a futures work, and despite the evidence we explore, it is not a work of history, nor is it a journalistic account of American higher education in 2019. Readers may extract some information along those lines, but that is

not the intent nor the structure of the text. Similarly, this book contains no narrative construction of American society in the early twenty-first century through 2019. As fascinating and revelatory is the story of American higher education from Harvard's founding to the creation of land grant institutions by a Vermont senator during the depths of the Civil War, the shaping of liberal arts colleges, the GI Bill, Sputnik's spur to science teaching, the enormous restructuring of the entire sector through the turbulent 1960s . . . we have time in the present volume only to reference rather than deeply develop that history. Instead, our account of American academia in this period is analytical rather than narrative, using the present and recent past as a springboard from which to launch into the future. We do take substantial time to assemble that springboard, if only to more carefully prepare the work of forecasting. Moreover, despite our futures orientation, this is not a work of science fiction, although one could consider parts of some of the scenarios to fall within that genre.

* * *

This book owes a great deal to thousands of people. Their insights, criticisms, and imagination have contributed enormously. Their stories constitute much of the materials in the chapters that follow. Any illumination, strategic benefit, or epiphanic understanding is theirs; errors and forecasts that veer wildly off the mark are solely my responsibility.

Trends

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1 Objects in Mirror May Be Closer Than They Appear

This book relies primarily on two forecasting methods, trend analysis and scenario creation. Its intention is to combine their respective strengths in order to generate the richest and most useful map of higher education's future. Their limitations are widely understood, and I will address them. Before discussing these two approaches, I raise several other methodological and popular assumptions concerning forecasting.

Thinking seriously about the future can raise a great deal of skepticism, much of which is warranted. It is both easy and often entertaining to find examples of predictions that failed to pan out. Science fiction has imagined futures in many ways, often portraying futures that could be generously characterized as alternative histories. Popular futurists have proclaimed things to come in serious tones, rarely admitting their errors when the future becomes the present. Even sober forecasters can be sideswiped by reality, as when many predicted a presidential victory for Hillary Clinton in 2016.

Yet these misprisions and inaccurate visions should not encourage us to entirely set aside futures thinking. Obviously, we need to think carefully about the future in order to plan anything, from individual actions to the grand strategies of complex organizations. But beyond that we can recognize the sustained hard work of the professional futuring world. This work usually dates to the middle of the twentieth century, when Cold War think tanks and strategists started developing new ways to forecast geopolitical events, especially in terms

of nuclear war. One group of practitioners in the 1960s and 1970s designed and iterated a scenarios method to help businesses and governments think through multiple futures. At roughly the same time the Club of Rome used emerging computer technology to forecast ecological and demographic trends; their work was enormously influential, helping to spark cultural and policy changes worldwide.

Over the following years the futures profession grew and developed. It took root in academia, with major departments at the Universities of Houston and Hawaii. Professional organizations matured. Schools of practice became well established, and methods were extensively documented. Businesses hired futurists as full-time employees or as consultants. This world is often overshadowed by pop futurism of various kinds, but its inhabitants continue their careful work nonetheless. They avoid the term *prediction* and instead help clients explore multiple possible futures. They sometimes prefer the term *forecast* to *future*, with its meteorological resonance. It is from that professional world that this book draws its methods.

A more subtle challenge to thoughtful futures work stems from a widespread belief in how the future works. A popular way to imagine the future is of a massively transformed society, thoroughly reconfigured by technology in particular, shot through by changes to human norms and daily life's minutiae. The *Jetsons* animated television series (1962–63) famously offers a paradigmatic example of this futuring mode, with family life, home spaces, and work all strongly remixed by imagined technologies, as does, its own way, the contemporary *Star Trek* TV series (1966–69). The film *Tomorrowland* (2015) updates this approach with a didactic edge, explicitly calling on the audience to strive for such a rebooted world and criticizing those who see futures in other terms.

Yet if in thinking through the problem of the future we start by looking backward rather than forward, we find that the reality of historical transformation offers a more complex and uneven model of changes, technological and otherwise. Starting in the early modern period, we see new developments implemented alongside the persis-

tence of traditional forms. Inventions contemporaries deem shocking end up adopted, yet those inventions may fail to eradicate many long-standing practices. World War I introduced mechanized transport at scale (trucks, automobiles, and aircraft, in addition to expanding the role of trains), even while horses and donkeys remained widely used. For a less catastrophic example, California has for two generations hosted the digital world's epicenter in Silicon Valley while also maintaining extractive industries, such as oil production, dating back to the early twentieth century and growing its agriculture sector. Part of California's water politics is explained by competition between these different historical strata, with agriculture demanding water to feed crops, industry requiring water for cooling machinery, and the wealthy installing water-wasting pools and fountains to indicate class status.

Similarly, some consumers today obtain news via Twitter or mobile phone apps, while others rely on journalism from television, radio, and even newspapers. Although new digital communication technologies emerge frequently, email—which dates to the 1960s—remains widely used, relied upon, and generally unremarked upon.[1] Self-driving cars are a popular theme at present, as they should be, yet the full panoply of human-piloted automobiles remain in use, even to the point of people living nomadic existences in them, building up communities, careers, and folkways.[2]

In general the future never wholly eradicates the past. Instead, the two intertwine and influence each other, coexisting and becoming adopted by different segments within a population. Understanding this dynamic offers a more accurate and productive way of approaching forecasting. David Edgerton refers to this this shift in our awareness, from seeing the future in terms of *The Jetsons* to a more accurate past-present coexistence, as the "shock of the old."[3] Metaphorically, I think of this as imbrication, the process by which new rocks or tiles are laid unevenly upon old ones. The newcomers partially obscure their predecessors (as when the future replaces the past), while at the same time partially revealing them (older practices persisting into the future).

The exploration in this book follows this mixed view. We look to not only what new developments emerge and transform higher education, but also to what will persist from our present and our past.

Trend Identification and Tracking

Trend analysis identifies major drivers of change from recent history and current events. We can isolate trends from background noise by outlining coherent and persistent activity that seems likely to alter the surrounding situation.

Identifying trends often benefits from environmental scanning practice, which is the continuous examination of current developments for new or repeated "signals" of change.[4] Within this practice it is vital to scan sources diverse in terms of stance (political, ideological, and so on), geographical location, content focus, demographics, and more. Conducted over time, environmental scanning can discern "signal strength," or a higher incidence of a certain trend, suggesting its rising importance. The greater the breadth of scanning, the better the chance of reducing bias. The longer the run of a scan, the better opportunity of detecting more developments, as well as the chance to track them over time. The Online Computer Library Center environmental scans of 2003 and 2010 offer a good example of this for the library world.[5]

To a degree, trend analysis can be considered a subjective process, more of an art than a science. This can lead to problems of bias, in that we may look for trends that we presuppose are significant, or to research in sources we find congenial. We can also avoid developments that we perceive as threatening our interests in some way. Conducting more objective analysis requires the use of checks and guidelines. Consulting experts, for example, can add validity and context to a given trend attempt. Using peer review or social media feedback can also limit subjective biases.

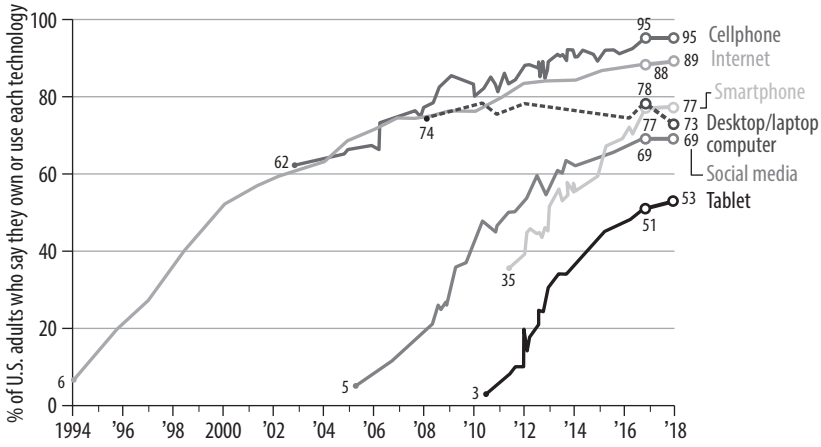
A greater challenge to trends analysis stems from its best application. Many forecasters and other practitioners use trends because of their tangibility and utility. Research into historical and present data

lets us ground trends in reality rather than building up futures through speculation. Research accumulated over time adds longitudinal data to a trend model, giving us insight into its strength (Is evidence for this driver increasing or decreasing?) and allowing quick extrapolation into the future. We can readily test trends against reality and check their veracity as well as their short-term impact.

That extrapolation offers the greatest utility. We can project a trend forward on the basis of its present and past presence. Decreasing sales of personal computers over the past decade, for example, can indicate an upcoming continued shrinkage in favor of other devices that perform some similar functions (tablets, e-readers, smartphones). Rising numbers for smartphone usage add to a forecast of an even more mobile-first world than we currently experience. Increasing economic inequality, measured by both income and wealth, could lead to a new gilded age. Persistent trends, such as the popularity of learning management systems among campuses, point to a future where they simply continue. Mary Meeker's Internet trends analyses are an example of such work, especially when well supported by research.[6]

But a quick reflection about extrapolation failures reveals the limitations of trends. Reality rarely follows straight-line projections. We can extend a rising trend line into the future by looking at clear metrics from recent history. For example, assume a given trend indicator stood at 8 in 2010 and 12 in 2015. We could therefore expect it to read 16 in 2020, but trends do not always proceed in a simple, linear fashion. They can accelerate (75 in 2020!), plateau (12 again), or reverse (back down to 8). A projection that American higher education enrollment would continue to grow because of steady growth in the 1990s would have been useful for the 2000s, but it failed to capture enrollment's downward break starting in 2012. Booming adoption of many leading devices for years or decades reached a plateau by 2016.[7]

There are striking limits to this trend extrapolation in the technology world. We are used to sudden and rapid change when it comes to digital devices and software, as when social media use went from



The share of Americans using various technologies has stayed relatively flat since 2016. *Source*: Pew Research Center survey conducted January 3–10, 2018. Trend data are from previous Pew Research Center surveys. Data on Internet use based on pooled analysis of all surveys conducted each year.

few to most American households in a decade.[8] Yet some technologies took many years, even decades, to make a splash. Podcasts appeared in the early twenty-first century, first named in 2004, but didn't achieve major audience and economic growth until a decade later, with the sudden popularity of *Serial* in 2014.[9] The first e-books date back to the early 1970s, as with Project Gutenberg's launch in 1971, more than two decades before Sir Tim Berners-Lee launched the World Wide Web, but e-books really didn't seize the public imagination or the consumer's wallet until Amazon launched the Kindle in 2007.[10] Even the famously fast digital world can experience slow developmental curves. To correct for extrapolation's capacity to err, we need other contexts and information to give our extrapolation line a better mapping onto reality. The following chapters attempt to supply such correctives.

More dramatically, trend identification fails to give us insight into "black swan events." Nassim Nicholas Taleb coined the term in 2007 to describe occurrences that are, statistically, extremely unlikely but

have enormous effects when they do occur. Recent black swans include the 2008 financial crash (recall how many analysts deemed the economy healthy at the time), the collapse of the Soviet Union, and the September 11 attacks. We can reach further back in time to find other instances, such as the shocking eruption of the First World War or the appearance of nearly every new religion. Black swans are, by definition, difficult to anticipate. In contrast, trends are often concerned with statistically likely events, rather than unlikely ones. This book touches on black swan possibilities for higher education, but not at length; they deserve treatment on their own beyond the scope of the present volume.[11]

Trend analysis is also dependent on the quality of research. The ancient cybernetic principle of garbage in, garbage out applies. One can easily fall prey to overdependence on certain sources, confirmation bias, and the excitement of change (or hype). To counter these challenges, I have conducted research with certain safeguards, starting with relying on the futures profession and futures scholarship to hone my practice. Further, I have published this research openly—shared through multiple presentations, articles, social media discussion, and a monthly trends report—all with the purpose of garnering feedback and obtaining reality checks from outside observers.[12] I have sought heterogeneous, skeptical, and openly critical audiences to push back on my research, as well as to bring attention to accounts and developments I might have otherwise missed. In short, I have conducted a distributed, continuous, and open research agenda. The following trends-focused chapters are the results.

Bearing these caveats in mind, we can recognize several established uses for trend analysis, starting with pedagogical benefits. The practice of examining multiple and diverse sources is a fine way to get out of one's personal or political bubble. Tracking trends across domains allows for interdisciplinary learning. It is difficult to resist making links between disciplines or other categories after considering trends, since so many developments engage with more than one. For example, we may consider the release of a large and open data set of

biological information as a good instance of the rise of big data in research. That can also be viewed as an instance of open education and open access in scholarly publication. One could search for additional examples in other fields, looking for patterns that indicate new trend lines. 3D printing now involves robotics, copyright, open source, and virtual reality. Trends intertwine.

In the chapters that follow I identify a series of trends. Each one is introduced in terms of recent history, a series of examples, and a quick extrapolative sketch for suggesting ways a given trend could play out over the next two decades. In addition, many trends appear in the company of countervailing trends. These are developments closely related to a trend but that work to weaken it. For example, one trend involves the rise of blockchain technology; a countervailing trend is the chaos surrounding bitcoin value and storage security.

Scenarios

In contrast to trends, a scenario is a work of fiction, a story told about one possible future. Generally, we create scenarios by starting with some part of the present, such as a geographical area or organizational type, then imagine how it would change under the impact of one or several trends. That part of the present can be as small as a single enterprise or as large as human civilization.

Formally, we can situate scenarios within the genre of science fiction, as they seek to envision different worlds, yet without the changes to reality's ground rules seen in fantasy. Scenarios are more qualitative than trends analysis, more speculative and ultimately subjective. They are narratives, clearly more art than science.

What, then, is the utility of scenarios? To begin with, because humans are narrative creatures, stories of the future can be powerful tools for helping us visualize different worlds. As Daniel Pink puts it, "Our tendency to see and explain the world in common narratives is so deeply ingrained that we often don't notice it—even when we've written the words ourselves."[13] The act of consuming a sce-

The Higher Education Crisis		
Student debt Campus mergers and closures Graduate school shrinkage Partisan and bipartisan political pressure		
Education and Contexts	**Education and Technology**	**Technology**
International education Racial inequality Sexual assault Athletics K–12 and higher education Macroeconomic indicators Library changes Alternative degrees Shared academic services Remedial classes Challenges to internships Adjunctification Green sustainability Demographics Executive compensation Enrollment changes Alternative certification Intergenerational tension Responses to Trump	The LMS world More MOOCs and online learning Gaming in education Badges Flipped classroom/blended learning Educational entrepreneurship Open education possibilities Crowdsourcing in academia Digital humanities develops Faculty criticizing deployment of technology Big data and data analytics	Internet of things New forms of creativity Digitization Augmented reality Limits of the Web Cloud computing Moore's Law Open source Office versus Web office Shopping online Copyright battles New interfaces Fragmented Internet Onshoring hardware
	Automation in education Blockchain in education Campus digital threats Crowdfunding in academia E-books in higher education Mobile devices in education Social media in education 3D printing in curricula Video and education Virtual reality in education	Automation's promise Blockchain Digital security threats Crowdfunding E-books Device ecosystem Social media 3D printing Digital video Virtual reality
	Maker movement Shared academics Rise of the net.generation	

Map of trends tracked by Future Trends in Technology and Education. Much design credit to Joanna Richardson and Ed Webb

nario (see the following paragraph for details) gives us a window into possibilities. That window can be personal, as we try to see how our work, our families, and our selves could change under the impact of certain transformative forces. The vision can also be social, as we think through how organizations of various types would respond to and be altered by the effects of a change agent. The latter purpose is one of the more commonly seen scenario uses, harking to how Shell Oil deployed scenarios of possible petroleum industry outcomes under the impact of geopolitics, starting in the 1960s. That social sense can include conflicting elements of a culture divide or opposed sides of a political issue. Scenarios offer a useful way for those contestants to interact creatively in a safe and supportive environment, as with the 1991–92 Mont Fleur Scenarios, which helped South Africa move past apartheid.[14]

I find it especially useful to consider scenarios as pedagogical objects. Simply put, they teach us to think in new ways. That function is performed when we read (or create) scenarios and imagine ourselves within their setting and story. The reader (or viewer, listener, player) imagines what it would be like to live in such a world. How would their professional work change? What would be different about their personal lives? Beyond the personally immediate frame, we ask ourselves broader questions. How would our government change? Our employer? Our religion? Our economy? Our ecosystem?

Anyone concerned with higher education's future can imagine how a given college or university would change. This might be the institution where you are a student, trustee, professor, or administrator. Imagine how your role would shift under the impact of certain changed times. It could be an imagined institution you are studying for strategic purposes, thinking about how a competitor may change over time, or seeking to analyze how best to change up a state system's offerings. You may wish to work through the ways each scenario addresses different types of college and university, comparing how a given future affects community colleges versus research universities, or state universities against liberal arts colleges.

For example, imagine a future academy after a major pandemic has struck the world, perhaps along the lines of the early twentieth century's Great Influenza. To envision the institution under such pressure, we would have to think through multiple disciplines and domains. We would have to consider, first, how such a thing would occur. This could involve delving into the history of disease, a look into graph theory for models of contagion, and a reflection on contemporary public health. We would then apply that learning to colleges and universities, a process that can ramify extensively depending on our awareness of the sector. Would distance learning grow rapidly as people fear face-to-face learning because of perceived contagion risk? Similarly, how would we take conferences and other forms of professional development online? Depending on the disease's death toll, should we plan on depressed demographics within a generation, or would the birth rate bounce back? Would athletes refrain from practice and play from fear of contagion, or would both institutions and the general public demand more college sports as an inspirational sign of bodily vigor in the context of sickness and death? Which academic disciplines would be most likely to grow in the disease's wake? And so on. This mental exercise dives into disciplines and then crosses between them in an example of inquiry-based learning.[15]

As is often the case with pedagogical materials, creating scenarios can be at least as powerful as consuming them. Creators must consider all of the above questions and then anticipate how a given audience would respond, setting up a communication or rhetorical problem. The creators must establish a plausible story line (How might a pandemic evade the World Health Organization and the many effective defenses mounted by contemporary medicine?), fusing multiple disciplinary learnings with narrative generation. The process can be both daunting and exhilarating, as I have found in leading many scenario workshops, as well as in building my own narratives.

The forecasting field offers many established scenario practices, starting with templates for scenario creation. As mentioned above, the simplest method is to select one trend and consider how it might

become powerful enough to noticeably reshape the domain under consideration. A more challenging approach is to build a scenario quartet. This begins by selecting two trends whose outcomes are especially uncertain or unstable, such as a given nation's stock market growth, or possible ways general artificial intelligence (AI) could play out. The scenario creator then identifies two extreme outcome positions for each. In this example, we could envision a stock market that booms to historic levels and, in extreme opposition, a market that collapses into depression. Similarly, we could reasonably imagine an AI powerful and friendly enough to manage a city into a splendid period, as well as AI that results in a horrific dystopia. Each of those trend extensions can shape a scenario on its own, but what's more productive and interesting is to create four worlds based on the combination of each.

1. A boom market with utopian AI
2. A boom market with dystopian AI
3. A collapsed market with dystopian AI
4. A collapsed market with utopian AI

These worlds can be visualized as quadrants:

Scenario 1	Market booming	**Scenario 2**
AI utopia		AI dystopia
Scenario 4	Market collapsing	**Scenario 3**

The creators of a quartet then develop each scenario's distinct features. They imagine what kind of changes would occur when a given trend pair confronts the domain in question. For example, if the domain was book publishing, we might create scenario 1, where publishing firms are booming thanks to growing demand from a wealth-

ier audience and rising investment from expanding financial houses. Good urban planning from benevolent AIs has led to higher levels of educational attainment, which also grow publishers. In contrast, scenario 3 sees presses shrinking or closing because of economic insecurity, declining investment, and resulting political instability. Malevolent AI implementations worsen things by instilling distrust in digital content, depressing e-book sales.

A scenario quartet's creator or creators then further develop each scenario by comparing details across the quadrant, especially looking for different elements as they address topics otherwise untouched. In our example, scenario 3 includes e-books, and scenario 1 does not. Our author or authoring team can now imagine what happens to that publication form under different conditions.

Note that in creating such a quartet we are led to trends marked by instability, rather than more predictable and stable trends. This four-scenario approach is well suited to exploring change drivers that are difficult to grasp. We can also present scenarios that offer a range of tones. A common strategy is to offer groups that are individually distinct: optimistic, even utopian; pessimistic, perhaps dystopian; one especially different from today, representing a strange future with radical breaks from the present; a fourth much closer to the present, emphasizing continuities and incremental change. The variety can engage a diverse audience through their inclinations and mental states, leading to interesting conversations. Each tone connects with a different predisposition.

There are many formal ways to connect audiences to scenarios. A classic method invites a group to imagine themselves inhabiting a scenario's world through role-play, often with the assistance of a questionnaire or question template. Participants envision playing various roles (professional, parent, citizen, etc.) by understanding how those future roles and their contexts would differ from today's. Alternatively, and more simply, a scenario exercise invites people to imagine themselves in that future, either in their current professional role or in

some dimension of their personal lives (as parents, members of a given community, fans of a certain musical style, etc.). They can be invited to present their experience to the rest of the group from that future perspective, or to engage in introductory planning based on those changes.

Another approach is more subversive. This one focuses on a profession or domain's official sense of its own future, based on public statements. The exercise begins by acknowledging and fairly representing that view through its presentation in the form of one scenario, then by adding to and complementing it with alternative scenarios. First, this process can empower a group to consider the fact that their organization or field has an official vision of the future and what that entails for planning, work, culture, and more. Second, the population can now openly consider alternative forecasts and possibilities, and then take a critical stance toward the prior consensus. As two of the foundational Shell Oil scenario developers reflected on their work decades later, "Scenarios facilitated dialogue in which managers' assumptions could safely be revealed and challenged. They enabled consideration of unexpected developments—such as the chairman's sustainability agenda in the 1980s—and inconvenient truths, such as OPEC's power over oil prices in the 1970s. They encouraged strategic conversations that went beyond the incremental, comfortable, and familiar progression customary in a consensus culture."[16] Naturally this approach can be challenging in terms of local and institutional politics, and must be conducted with tact and care. Some form of discussant anonymity, such as that found in Chatham House rules, under which ideas and statements can be reported on without identifying individuals speakers, is often advisable.

I find another approach especially useful. After introducing a group to a set of scenarios, I invite them to share the one they deem most likely to transpire, and then to offer their reasons for that assessment. (This is an area where technology can augment a face-to-face session. A digital poll using smartphones or personal response devices can elicit answers from the entire group, rather than the relative few who feel comfortable speaking.) After that discussion I ask the question

again, but with a twist: which scenario would they *prefer* to occur? The answers can, unsurprisingly, differ, and then lead to a discussion of the group's role in shaping the future. This returns agency to the audience, an important step to take because many people tend to view the future passively, as something that will be done to them, in which they play no active part. Brainstorming and planning for next steps, such as a gap analysis, naturally follow. Scenarios in general tend to be good at getting people talking, as we are narrative creatures, trained by a lifetime of experience in responding to stories.

In the chapters that follow we will explore both scenarios and trends. All are grounded in the present day, using evidence of current developments as springboards for envisioning the future of American higher education.

* * *

One final note: as mentioned in the introduction, please read what follows with a sense of openness and possibility. These trends and scenarios, backed with evidence, may give you a feeling of inevitability. They are, after all, expressions of powerful forces in the real world. Yet do not lose your sense of agency. If you are a student, trustee, security guard, or provost, you have the ability to make some impact on what becomes of American higher education. Karl Marx famously observed (with the nineteenth century's typical sexism) that "Men make their own history, but they do not make it as they please; they do not make it under self-selected circumstances, but under circumstances existing already, given and transmitted from the past." These trends and scenarios represent those circumstances; what you make from them is in your hands.

2 Catching the University in Midtransformation

In this chapter we examine trends reshaping American academia that stem from the full range of educational experience and institutional issues: policy, enrollment, interinstitutional issues, and staffing domains, among others. Some appear here mostly because of reasons internal to education systems, while others draw some of their force from external developments. Each trend appears with an explanation of how it currently functions, including examples and considerations of how it might play out, should it persist and influence postsecondary education.

The Internationalization of Education

American higher education is increasingly connected to, if not actively situated within, global academia. While it is to some extent cliché to point to globalization's continued effects, colleges and universities in the United States are more intertwined with the outside world than ever before, the recent neonationalism of President Donald Trump notwithstanding. As a result, campuses are increasingly subjected to pressures, opportunities, and incidents from other nations, which can yield intersections in geopolitics or across cultures. The reverse is also true as American institutions assert themselves across the world through scholarship, teaching, outreach, and professional collaboration, not to mention in connection with national policies.[1]

US campuses have opened hundreds of branch campuses since 2000. Their forms have ranged from small offices to entire academic

enterprises, such as Yale's Singapore campus, where classes opened in 2013, or the partnership between the University of Washington and Tsinghua University to create a multinational technical institute in Seattle.[2] At the same time other nations have invested in American higher education. Perhaps the most notable has been Chinese Confucian Institutes, which are housed in roughly one hundred American colleges and universities.[3]

These international academic exchanges can be fruitful for scholarship, teaching, and intercultural learning. The recent growth of these exchanges has given rise to ethical, political, and institutional culture challenges. For example, how can an American campus dedicated to the free exploration and expression of ideas hold classes in a nation whose policies restrict those activities, as when Singapore welcomed an American undergraduate campus largely provided by Yale but also banned student demonstrations there?[4] The American Association of University Professors (AAUP) issued an open letter expressing concern about Yale's Singapore campus and its illiberal learning environment.[5] In a similar case, the European Higher Education Area admitted Belarus to its international academic articulation agreement system, despite that Eastern European country's human rights issues.[6] How do American academics abroad respond when a host nation's administration threatens and jails local faculty members, as has occurred in Turkey?[7] When does an academic unit associated with one nation become perceived as a political challenge in another? Faculty members may publicly protest policies, as professors did on several North American campuses concerned about institutional engagement with Saudi Arabia's conservative policies.[8] Ironically, we may be experiencing a global clash of liberal education with rising illiberalism. There are open and strategic questions about how American academia might have a beneficial impact on other nations, to what extent the former should compromise with the latter. These are questions not unfamiliar to those faced by digital companies in the United States that are seeking to operate in illiberal or authoritarian nations.[9]

Beyond the rising interconnections of institutions worldwide extends the international flow of students. A crucial element of higher education's internationalization has been the rising number of learners who study in other nations, both online and in person. Some American students (predominantly female and white) study abroad, while millions of students from around the world, especially from east and central Asia, arrive on US campuses from Hawaii to Maine. About 4.5 million students followed this transnational pattern in 2015, with 1 million attending American classes in 2017. Meanwhile, American campuses from the 1990s on increasingly recruited students from around the world, marketing themselves to potential students in east and central Asia, the Middle East, and Europe.[10] A recent strategy targeted Brazil as a new recruiting market, encouraged by the US Department of Education under President Barack Obama.[11]

One of the signal developments of the past generation in education history has been the emergence of a truly global higher education marketplace. Levels of university and college educational attainment have increased since 2000 in countries that are part of the Organisation for Economic Co-operation and Development (OECD).[12] The fact that many people worldwide self-identify as global citizens may both empower and illustrate this development.[13] We can see many signs of this enormous trend, such as the establishment of international rankings for universities by their research output, as well as the drive to rank campuses across national borders by their teaching, or the launch of Chinese and Israeli liberal arts campuses to compete with that distinctively American academic form. Holland has also expanded its liberal education sector.[14] A British Council report found some leading nations in the "transnational" student market to include Hong Kong, Malaysia, Qatar, Singapore, South Korea, and the United Arab Emirates.[15] This trend often emerges in international competition and can be shaped by geopolitics. In the wake of a summer 2018 diplomatic incident, the Saudi Arabian government withdrew its students from Canada; in response, enterprising America universities reached out to attract that population.[16] Hungary's na-

tionalist government has repeatedly taken steps against an American university in that country.[17]

But the rising international market backfired for the United States after years of increasing engagement. Foreign students became the main driver for increased graduate school populations after the Great Recession: "Between fall 2011 and fall 2012, total graduate enrollment increased 2.8% among temporary residents, but fell 3.2% among U.S. citizens and permanent residents."[18] There were danger signs in 2013, which saw "the smallest growth in applications over the past eight years," with private institutions especially hit.[19] Growth picked up again for the next three years, then reversed under the dual impact of the Trump administration's immigration policies and media coverage of school shootings, not to mention "the increasing lure of schools in Canada, Australia and other English-speaking countries."[20] In fact, most nations beyond the United States continue to see international enrollment rise.

Australia saw a 12 percent increase in international students last year. Universities in Canada, China, Japan, New Zealand, and Spain all posted double-digit increases in international enrollment, according to data from the nonprofit Institute of International Education.[21]

While China welcomes more international students, it is possible that that nation will send fewer of its students to the United States.[22] China's desire to rebuild its university system after the Cultural Revolution and to grow it into a world-leading academic enterprise has led to many students bringing home American degrees over the past several decades. But this trend could well reverse. First, Chinese university systems will someday be able to produce more excellent PhDs than America can, which could decrease the number of students crossing the Pacific for higher education. Second, geopolitics could intervene. Recent tensions between Washington and Beijing, from Trump's trade war to accusations of spying, could erect barriers to international study.[23] The Chinese government defended its US Confucius Institutes against American criticism.[24] Wellesley faculty recommending ending a partnership with a Chinese university if that

nation prosecuted a faculty member for his political views.[25] Third, some American faculty express concerns about the quality of some Chinese students, and they could exert institutional pressure to reduce the numbers of these students.[26] A multiagency operation arrested a dozen Chinese students for cheating in both college entrance exams and immigration processes.[27] Such competition for international students abroad and decline in terms of domestic enrollment place significant stress on many American colleges and universities in terms of achieving revenue and growing student body diversity.

Racial Inequality in/and Education

A major domestic trend has been unequal access to higher education by race. Broadly speaking, Asian Americans and whites are and have been for decades more likely to have greater college and university experience than blacks, Latinx, Native Americans, and Pacific Islanders. Black students tend to hold higher debt amounts than white students.[28] Black women frequently do not receive significant financial gains from higher education, according to one study.[29]

Many policies and practices have sought to address these inequalities, including the creation and maintenance of historically black colleges and universities, Hispanic-serving institutions, affirmative action in multiple forms, scholarship funds, and more. Student groups have been organized by these populations to support their members, including Greek houses and empowerment associations. Academic units devoted to race and ethnicity studies have proliferated across American academia. Some institutions focused their enrollment strategies on racial minorities; for-profit higher education grew largely in the 1990s and 2000s by serving increasing numbers of people of color.[30] More than two hundred American colleges and universities maintain bias response teams in 2016, according to the Foundation for Individual Rights in Education (FIRE).[31] Some gaps have narrowed, as with black and Latino students attending law schools in greater numbers, and rising numbers of black and Latinx PhD students.[32]

As of this writing, however, racial gaps in higher education persist, driven by structural racism as well as local inequalities in supporting K–12 school districts, and despite the rising proportion of nonwhite populations within the overall American population.[33] The Latinx population has a lower educational attainment and postsecondary preparation than white or black Americans, with negative impacts on earning, according to recent research.[34] One recent study found that higher education degrees generally did not protect black and Latinx families from the recent recession.[35] Hiring practices biased against black and Latinx would-be employees have remained the same since 1989, according to a new meta-analysis. New research suggests that K–12 teacher expectations of students can vary by race, with significant impact on subsequent college degree completion results.[36] While the proportion of nonwhite university administrators has been increasing, accompanied by racially equitable pay, that increase has not kept up with either increasing numbers of racial minority college graduates, nor with the general proportion of racial minorities within American society.[37] At an institutional level, historically black colleges and universities tend to pay more in finance charges for bonds than do other financially comparable campuses.[38]

Recently a series of initiatives, protests, and movements have emerged, partly in response to America's broader reconsideration of race and racism. In the age of Black Lives Matter, the Trump presidency, and the influence of Ta-Nehisi Coates, it's unsurprising that academia has participated actively in conversations and events. The 2015 antiracism protests at the University of Missouri won national attention. At least one dozen American campuses that November saw student protests against racist history and current policies.[39] Several administrators resigned as a result, and others were asked to step down.[40] Subsequent protests against policies and speakers have elicited media coverage and political controversy from Yale University to Middlebury to the College of William and Mary. A City University of New York (CUNY) organization may be representative of

antiracist campus activism, especially as those campuses largely serve students of color:

> The CUNY Rising Alliance is a broad coalition of member organizations who serve, represent and minister to millions of New Yorkers. The communities and constituencies we work with are the most hurt by policies of austerity and disinvestment from public institutions like CUNY. Living in a city with record income inequality and profound, systemic racial disparities in education, our constituencies depend on a quality CUNY education to begin to level the playing field of opportunity. That's why CUNY Rising is advocating for a Students' Bill of Rights for ALL New Yorkers.[41]

Such activism attracts support and opposition, both online and off. Digital opposition, often organized through social media, can escalate into threats of violence and murder, in turn driving activists offline or to avoid public appearances.

Campuses and Sexual Assault Controversies

Higher education has long struggled with how to respond to sexual harassment and assault on campus. This issue became more salient in 2011 when the Obama administration requested that colleges and universities alter their sexual assault policies in line with Title IX.[42] In response some administrations intensified proceedings against alleged offenders, improved support for victims (sometimes outsourcing that support), and expanded education programs, a process that sparked controversy, lawsuits, and much media attention. Multiple studies offered different assessments of campus sexual assault prevalence depending on definitions and data sources.[43] The number of reported campus sexual assaults grew through 2015, according to federal data.[44] A documentary film about campus sexual assaults, *The Hunting Ground*, received attention and criticism that year.[45] Simultaneously, students at a liberal arts college published a YouTube video criticizing campus responses to sexual assault.[46]

A growing national conversation about sex crimes generally recognized campus stories. By 2016 the *Washington Post* had published a ranking of American colleges and universities based on reported incidence of sexual assault.[47] Some US senators criticized campuses for not doing enough to stop assaults, while several others released information showing that the US Department of Education takes more than four years on average to investigate complaints about campus handling of sexual assaults.[48] Democratic presidential candidate Hillary Clinton raised campus sexual assault as a campaign issue.[49] After several years the drive to create a learning and scholarly environment free of rape and harassment had become a significant force. The #metoo movement, launched by sexual assault survivors on Twitter in October 2017, further heightened academic concerns about this problem.

This trend has manifested in several ways, including many campus proceedings against accused attackers and harassers, at times eliciting legal actions from accused perpetrators who charged campuses with unfair or racially biased proceedings.[50] A series of high-profile faculty members suffered dismissal, demotion, bad publicity, or a mixture of these following claims of abusing the power they held over graduate and undergraduate students.[51] The Trump administration explored policy changes to the guidance implemented by Obama's Department of Education, eliciting a wave of criticism.[52]

Library Changes

Libraries have been facing down technology-driven challenges to their operations since the 1980s, when librarians developed a global digital record standard (MARC), started putting physical card catalogs into storage, and first began teaching people how to find information in a digitally networked world. Few professions have been so far-sighted, so collaborative, and so forthright in action.

Yet academic libraries face potentially declining usage. For example, a 2012 survey of undergraduates found that 40 percent saw their campus library as disconnected from their academic career, while

only 20 percent ever spoke with library staff, representing a disturbing trend.[53] To redress that potential shortfall and to meet the changing needs of users or patrons, libraries have expanded their offerings, adding more study spaces, makerspaces, collaboration areas, and commons areas for collaborative learning.

Looming over academic libraries is the threat of budget cuts, which can be doubly challenging when certain costs, such as journal subscriptions, rise steeply. The University of California, Berkeley, floated the idea of downsizing its library, only to withdraw the proposal after widespread faculty opposition.[54] Even wealthy Harvard contemplated strong cuts to its libraries, four years out of the Great Recession's depths.[55]

Digital libraries have often appeared and developed in distinct ways. In Boston the Digital Public Library of America (DPLA) opened its Web doors in 2013, hosting no content itself but instead creatively organizing ways to reach open digital content hosted by other cultural heritage organizations.[56] Many universities maintain digital repositories for faculty- and student-created content, expanding access to that work. Others digitize their special collections so that they are available to a global audience.

Academic Labor: Adjunctification and Administration

At some point in the first decade of the twenty-first century the majority of American professors became adjunct faculty. Rather than being tenured or on the tenure track, instead of being tenureless but employed full-time and under extended contract, the normative college or university instructor was a part-timer, hired or not hired each semester. The proportion of faculty occupying some position on the tenure track dwindled to a minority, perhaps as low as 30 percent of the entire American professoriate.[57] A 2016 AAUP report found that "the majority (70 percent) of academic positions today are not only off the tenure track but also part time."[58]

By 2018 the same organization found 73 percent of faculty to be off the tenure track.[59] The majority of that majority relies on teach-

ing for their primary income, as opposed to using teaching as an adjunct to other employment, which is the older model.[60]

No single person or office made this decision, nor was it the result of a conspiracy. Instead the adjunctification of the professoriate occurred owing to the confluence of several drivers, starting with the fact that research university PhD programs produced more graduates than the academic market could accommodate with tenure-track positions. To pick one example, in 2012 the number of PhD graduates without employment increased to 34.5 percent, according to the National Science Foundation, indicating a continued flow of adjuncts.[61] Enrollment grew from the 1980s on, and because higher education does not scale instruction well, that meant hiring new faculty members. This uptick in faculty hiring occurred during rising anxiety about college costs, along with declining per-student support from states to public institutions, driving many campuses to hire adjuncts for economic and political reasons. Additionally, we can understand this outcome as an expression of changes within the broader American labor market, which shifted away from unions and, ultimately, toward a part-time economy. Further, there is no established view that adjuncts are inferior instructors in comparison to tenure-track faculty, although adjuncts usually lack the ability to engage more closely with students, especially over time. A Wabash College study argued that different levels of faculty salaries and course load have no impact on student engagement.[62] Another study claimed that students learned better with adjunct faculty than those on the tenure track, serving students who were less well prepared especially well.[63] We can see a sign of that generally positive attitude toward adjunct teaching quality in the American Bar Association's decision to explore allowing law schools to teach more classes with adjuncts, and fewer with full-time faculty.[64]

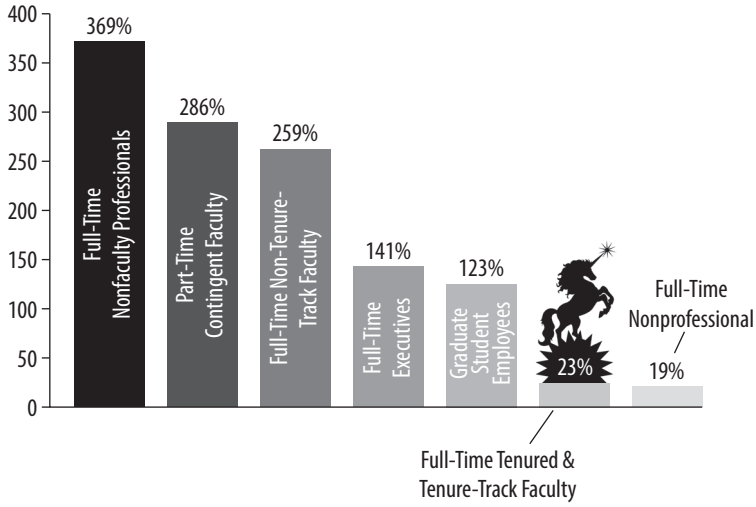
This gradual but decisive transformation of the professoriate has had several consequences. First, it has reduced the protections that tenure offers to faculty, rendering more people vulnerable to political pressures both within and beyond the academy. Second, it represents

a professional and in some cases humanitarian catastrophe to those who devoted their lives to an academic mission but found low pay if not outright penury as a reward. The US Census Bureau in 2011 estimated that hundreds of thousands of people with graduate degrees rely on public assistance for survival.[65] Third, academic labor as a whole has been devalued economically and politically. We may be seeing secondary impacts on tenure itself. Administrators at Wisconsin's public universities now have the power to conduct faculty post-tenure reviews without participation from other faculty members.[66] Legislators in Iowa and Missouri introduced bills to end tenure at public and local colleges and universities.[67]

As of this writing no major countervailing force resists the adjunctification drive, and the pressures to reduce higher education costs remain intense. Leading research universities continue to overproduce graduates from their PhD programs. There seems to be no political appetite in statehouses to increase the number or proportion of tenure-track faculty.

Instead, a unionizing movement that seeks to improve adjunct conditions has been growing nationwide, aided by a National Labor Relations Board statement making it easier for private college and university faculty to unionize.[68] Adjuncts at several Washington, DC, campuses organized under the banner of a service union.[69] Tufts University adjuncts voted to unionize in a movement aimed at other Boston-area schools.[70] Adjunct unionization drives continued across other regions as well.[71] Adjuncts at McDaniel College voted to unionize.[72] In some instances adjuncts partnered with other populations. Tenure-track University of Minnesota faculty members backed away from a unionization drive because the campus wouldn't include adjuncts within the body.[73] Faculty at California State University, Monterey Bay, proclaimed their desire to strike for higher compensation, including adjuncts.[74] A Pittsburgh university's adjuncts voted to unionize and partner with steel workers.[75]

In parallel to adjunctification is the steady growth of administrative staff. Recall that the term *administrator* describes nearly every



Changes in academic labor force composition from 1975–76 to 2011. There were massive increases in academic staff and adjunct numbers. *Source*: Joseph Fruscione and Kelly J. Baker, eds., *Succeeding Outside the Academy: Career Paths beyond the Humanities, Social Sciences, and STEM* (Lawrence: University Press of Kansas, 2018), 2

single university employee who is not a faculty member. It includes presidents and custodians, deans and librarians, grants officers and counsel. Ever since the 1980s the numbers of administrative staff have grown steadily, both in absolute terms as well as a proportion of all academic workers.

This development is extremely important, representing at the very least a transformation in campus labor. Increasing numbers of administrative staff play a role in driving up campus costs. For some critics this trend also indicates a reduction of faculty roles or, worse, compromises academic missions.[76]

The reasons for administrative growth (called "administrative bloat" by some critics) are various. They include technological change (consider the numbers of staff needed to maintain digital infrastructure), regulatory compliance, the rise of new services to better support students (residential life, mental health counselors, para-curricular centers, accessibility support for those with learning disabilities, etc.),

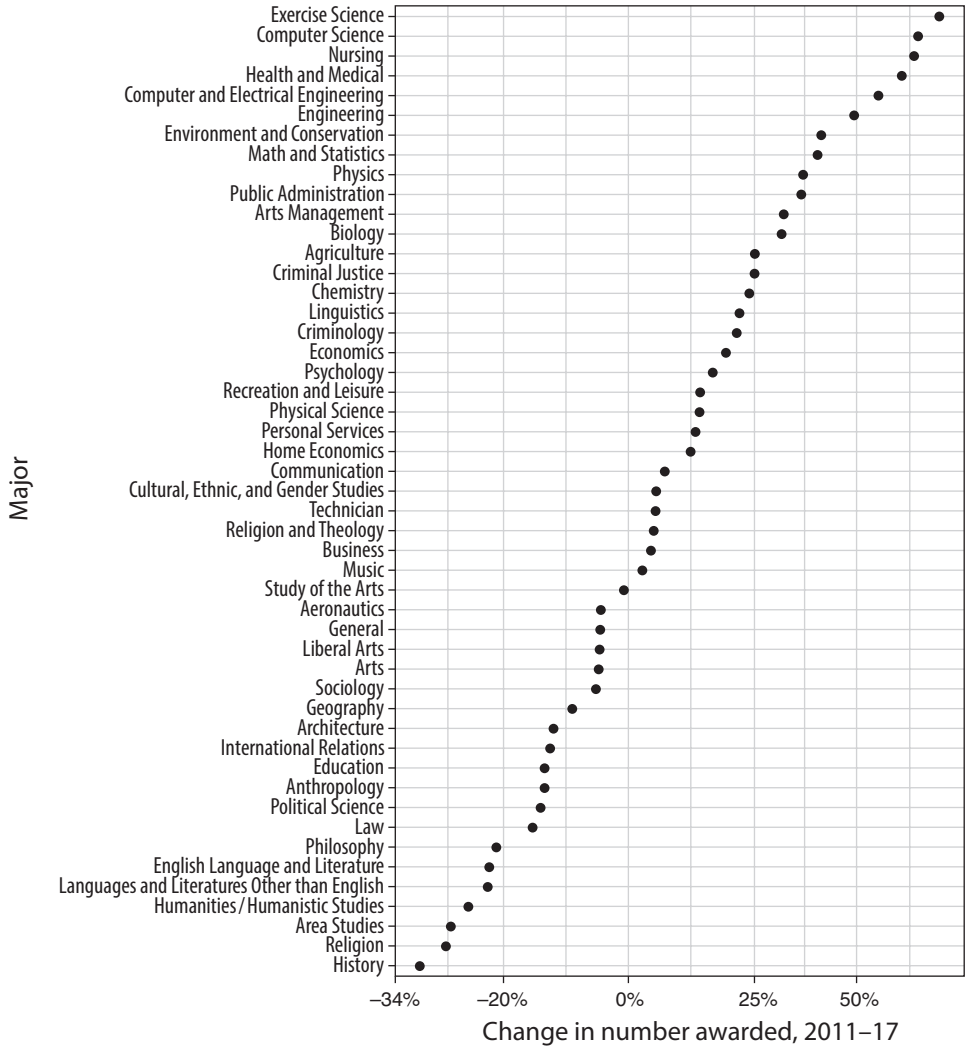
and empire building by ambitious senior administrators. The numbers of administrators also grew with a generation's boom in student enrollment, as more students require additional staff. These reasons appear fairly durable at this point, and so they seem likely to continue. Moreover, it is hard to imagine cutting many services upon which campuses have come to rely.

Enrollment Changes

Major changes to higher education enrollment have been occurring over the past decade and seem likely to imprint themselves on the near-, medium-, and possibly long-term future. Several factors contribute to inequitable access to higher education. I noted racial bias above, especially the comparatively low enrollment—and completion rates—among black, Latinx, and Native American populations as compared to white and Asian demographics.[77] Added to this unevenness is enrollment differentiation by economic class. Poorer Americans are less likely to attend college than wealthy Americans. And the highest-achieving poor students are less likely to enroll than the lowest-testing affluent students.[78] Several researchers, among them Robert Putnam, have determined that inequitable primary and secondary school funding, staffing, curriculum, and advising are most strongly shaped by class, and that this disparity is widening in higher education and in American society as a whole.[79]

Enrollment is also changing in terms of disciplines and majors. Generally speaking, over the past two decades, more students have been taking classes in the sciences and in business, while fewer study the humanities and the arts. This tendency has been evident in both undergraduate and graduate programs and has accelerated since the 2008 financial crash.[80]

There are many reasons for this shift, starting with the move of women students into the science, technology, engineering, and mathematics (STEM) disciplines as careers in those fields opened up to all genders, whereas previously many women were confined to the humanities. The growing reputation and excitement around technology



Changing enrollment by major, 2011–17. *Source*: Benjamin M. Schmidt, "The History BA since the Great Recession," Perspectives on History, November 26, 2018, https://www.historians.org/publications-and-directories/perspectives-on-history/december-2018/the-history-ba-since-the-great-recession-the-2018-aha-majors-report

fields play a role, with the humanities being seen as generally less engaged with the digital world. One observer's analysis of humanities scholarship as massively overproduced and underutilized further suggests a reputational decline for those fields.[81] The reputation of the humanities for not leading students to middle- or upper-class jobs persists as anxiety around student loan debt has grown, especially during the Great Recession.

As the broadest level, total enrollment in American higher education has been declining since 2012–13. It is difficult to overstate what an enormous change this is. The number of students attending colleges and universities generally increased from 1970 until 2012. The National Center for Education Statistics (NCES) offers an overview: "Undergraduate enrollment increased 47 percent between fall 1970 and fall 1983, when it reached 10.8 million. Undergraduate enrollment dipped to 10.6 million in 1984 and 1985, but then increased each year from 1985 to 1992, rising 18 percent before stabilizing between 1992 and 1998."[82]

With hindsight we can see this movement as a historical boom, a major expansion on par with that experienced during the land grant revolution of the late nineteenth century or the post–World War II boom caused by the GI Bill and the Sputnik science panic. For a generation, American colleges and universities have grown, planning on that expansion and literally banking on its continuance. Within the University of California system, for example, "between 1990 and 2015 total enrollment grew from 166,500 to 257,400—a staggering 90,900 students, mostly at the under-graduate level."[83] By 2014 the majority of twenty-seven-year-olds had college experience.[84]

But since that time growth stopped and has actually retreated. In 2013, US campuses enrolled 19,105,651 students. During the spring of 2018 that number stood at 17,839,330, a decline of roughly 6.7 percent over five years, and one that occurred every semester in that half decade.[85] The implications of that historical change are discussed elsewhere in this book.

While that enrolled population has shrunk, it has also changed in other ways. Adult learners, sometimes dubbed "nontraditional" students, occupy a great many undergraduate seats, if not (yet) a majority. Statistics vary depending on the data source, year considered, and definition. One source found that "38 percent of the 2007 enrollment of more than eighteen million college students were twenty-five years of age or older."[86] A 2010 article claimed that "more than 47 percent of students who are currently enrolled in colleges and universities in the United States are older than 25."[87] In 2017 the NCES reported that "in 2015, there were 11.8 million college and university students under age 25 and 8.1 million students 25 years old and over," or around 40 percent of adult students.[88] It's not surprising that the New School labeled its adult learning programs "Great Colleges for the New Majority," as we can easily imagine a future where eighteen-year-olds constitute a postsecondary minority or even a niche market.[89]

At the same time as the adult population grows, a population younger than the traditional-age undergraduate is increasingly involved in higher education. Dual-enrollment programs that connect high school students to college coursework have been expanding over the past decade, particularly within the community college system. Other colleges have opened high school programs or entire high schools, such as Bard College, which opened a new early-college high school in Newark, targeting poor teenagers to help them overcome weak college preparation in K–12.[90] According to Columbia University research,

> Nationally, 15 percent of fall 2010 community college entrants were high school dual enrollment students; this proportion ranged from 1 percent in Georgia to 34 percent in Kentucky . . . [W]e estimate that the number of high school "dual enrollment" students grew 67 percent from 2002 to 2010, to a total of nearly 1.4 million in the 2010–11 academic year . . . [F]rom 1995 to 2015, fall enrollments of students aged 17 or younger at

public four-year institutions grew from 72,000 to 220,000, while at community colleges they grew from 163,000 to 745,000.[91]

That research also found that economic class strongly marks the path of those students once they exit high school. Learners from higher-income backgrounds were much more likely to attain a degree or certificate than those of lower socioeconomic status, which aligns closely with broader enrollment and completion trends. Related to this development is the increase in the proportion of American students who work full-time while taking classes: 19.6 percent of undergraduates and 45.9 percent of graduate students in 2011.[92]

Beyond expanding to the adult and high school worlds, the student population has changed in other ways as well. For the first time in American history the majority of college students are female. More female than male high school graduates went to college in 2012, 71.3 percent of women versus 61.3 percent of men, continuing the recent trend of gender skew in traditional-age undergraduate population.[93] As of 2015, 56 percent of undergraduates were female, and the majority of baccalaureate degree holders were also women. And there are few signs of that gender balance reversing.[94] As the population becomes less white, the student body reflects that increasing diversity.[95] A growing number of students are veterans, as America has fought (and still is fighting, as of this writing) the longest war in its history. Some veterans organize their education online, and some (but by no means all) campuses have designed services to support military students. In addition to military status and gender changes, a growing number of college and university students have learning disabilities of various types, from attention deficit and hyperactivity disorder (ADHD) to dyslexia. Beyond these features, a growing proportion of learners are first-generation college students, who often face challenges in navigating the unusual world of a campus. As political leaders, business executives, and university representatives call for more people to take more postsecondary classes, the population who answer that call are increasingly likely to be the first in their

family to enroll in schools beyond high school. Meanwhile, teenagers, traditionally the population pursuing undergraduate education, are increasingly being treated for depression, anxiety, and self-harm.[96]

Taken together, American students are more likely to be older, nonwhite, female and first-generation learners and to have military experience than ever before. This has significant implications for college and university planning, from recruitment to advising, pedagogy, and residence life.

Grad School Woes

Although some of American graduate education remains in fine repute worldwide, other sectors face challenges, especially law schools. The 2008 financial crash saw many corporations slash the number of attorneys they retained, while automation gradually suits itself to some legal functions, such as document discovery, contract completion, and access to justice. As a result law school enrollment has plummeted; in 2016, the majority of American law schools saw enrollment decline.[97] Half of law schools are reducing the size of their entering classes.[98] Scores on one major law school exam declined to the lowest levels on record.[99] California bar exam pass rates fell to a multidecade low, possibly because more schools are accepting underprepared students to maintain tuition income.[100] The number of law students paying full tuition has slid.[101] Two students sued the Charlotte School of Law, charging "the law school [with] engaging in misrepresentation, unjust enrichment, breach of fiduciary duty and constructive fraud."[102] Five law schools were threatened by sanctions because their graduates' incomes have been threatened by swelling debt.[103] The number of students taking the LSAT declined sharply for several years, and scores of admitted students seem to have dropped out.[104] Recent law school graduates continue to have a hard time balancing a challenging job market with large student loans.[105] In response to graduates' debt and jobs problems, President Obama called for law school to be a two-year, rather than three-year, program.[106]

It is possible that the law school crisis will ultimately correct itself. Fewer people entering law combined with a steady flow of retirements may open up the legal job market.[107] But the crisis may be worse than it appears, as universities and state governments would prefer to operate law schools at a loss if it means retaining their cultural and academic prestige.[108]

Another graduate school sector has encountered challenges in recent years. Starting in 2013, MBA graduate salaries ceased rising, or actually declined, depending on the degree holder's experience.[109] In 2013–14 the number of MBA hires declined dramatically, putting pressure on that graduate field while one stand-alone MBA school sold its campus as applicant numbers continued to drop.[110] The University of Wisconsin considered closing its MBA program.[111] By fall 2018, MBA applications declined, according to one survey.[112] Admissions to middle- and lower-ranked MBA programs are down, partly because of falling international enrollment.[113]

Alternative Certification

One of the most obscure features of American academia is also one of the most powerful. The ability to certify postsecondary learning through grades, degrees, certificates, and transcripts is held by relatively few organizations, and jealously maintained and defended by colleges and universities. We can understand certification through an ecosystem metaphor, once we realize the fierce competition for relative value among institutions. The ecosystem also circulates among institutions, as a quiet yet meticulously detailed interplay exists for communicating and transferring certification information, not just between instructors to registrars to curriculum committees within the same campus but also between them. Departments and universities fiercely struggle over which learners' credits can be transferred between institutions.

This certification ecosystem is gradually being expanded or challenged by new forms and issuing entities. Microcredentials, such as badges, describe achievements and learning at a level smaller than

that of a single class. They can certify learning that occurs within a class but is not represented by a letter grade, as well as education that transpired between multiple classes and the outside world. Examples include technical skills (think of learning the PHP programming language as part of several different class projects) and social skills (small team management, learned through internships, sorority service projects, and capstone projects). Issuing authorities include colleges and universities as well as businesses, nonprofits, and government agencies. One widely used initiative is Open Badges, coordinated by the Mozilla Foundation.[114] Course management system provider Blackboard announced a badges function for its software, in partnership with Mozilla.[115] Over the past decade the number of certificates awarded rose steadily, from less than 2 percent of Americas owning at least one to nearly 12 percent in 2009, totaling around one million people. These certificates include "awards from business, vocational, trade, and technical schools, and technical and non-degree degree awards from two- and four-year colleges."[116] The US Census puts the total higher, finding that 25 percent of Americans have "a professional certification, license or educational certificate apart from a postsecondary degree awarded by colleges and universities."[117]

Perhaps the most successful alternative certification has been the Biliteracy Seal, which certifies that the bearer can speak competently in two languages. Launched by the nonprofit Californians Together, the Biliteracy Seal can be awarded by high schools and school districts and is ultimately backed by state governments. As of this writing more than forty states certify that learners are literate in two (or more) languages, while some of the remaining ten are considering it.[118] Colleges, universities, and employers can recognize the Biliteracy Seal as a way of assessing a student's language skills. Either seeking to build on the certification's success, or looking to compete with it, the American Academy of Arts and Sciences called for badges to document second-language learning skills.[119]

A different certification movement seeks to capture, describe, and reward learning that occurs outside of classes. Competency-based

education (CBE) pays special attention to learning on the job as well as self-directed learning. Colleges and universities use assessments to determine what kind of learning has been done, and to what level, and then assign recognition, sometimes in the form of academic credit. This is especially useful for adult learners who have more time and opportunities for extracurricular learning than traditional-age undergraduates, as well as for students of any age hoping to reduce college costs by reducing the number of classes needed to attain a degree. For example, the University of Wisconsin launched a new degree, UW-Extension, which allows learners to win academic credits through competency tests based on life experience rather than completed class work. The University of Wisconsin is the first public university to adopt the competency assessment model. Late in its first term the Obama administration published guidelines to help states and universities implement CBE.[120]

There are additional motivations for building CBE capacity. Mapping a learner's accomplishments beyond formal school credentials can increase an institution's ability to respond to that student, as with personalized learning. A campus can implement CBE to map and respect current students' work, allowing a more flexible path through the institution. Further still, some see CBE as a way of getting away from measuring learning via "seat time," or the traditional progress through a structured curriculum.[121]

Several projects and organizations have sprung up to integrate CBE into the broader credentialing ecosystem. The Western Interstate Commission for Higher Education launched the Interstate Passport Network to help facilitate CBE recognition across state lines.[122] The Competency-Based Education Network (C-BEN) seems to be the leading professional development organization.[123] The peer-reviewed *Journal of Competency-Based Education* published one volume in 2016.[124] The Lumina Foundation published a CBE framework in an effort to encourage standard setting and usage.[125] A new nonprofit, Credential Engine, seeks to aggregate data about higher education credentials in one spot and partners with relevant organizations.[126]

Academic Responses to the Trump Administration

The election of President Donald Trump shocked many in higher education. Academic supporters of the Democratic candidate, Hillary Clinton, were dismayed, as were faculty, staff, and students opposed to the Republicans' avowed policies and rhetoric, notably those concerning sexual harassment and immigration. Since taking office Trump directed US Immigration and Customs Enforcement (ICE) to escalate undocumented immigrant detention, which many saw as threatening members of campus communities, including students covered by the Deferred Action for Childhood Arrivals (DACA) policy.

In response faculty, staff, and students have mounted protests, either on campus or through joining general demonstrations, including the Women's Marches (2017, 2018) and the March for Science (2017). Some colleges and universities developed policies to protect DACA students. Others took public positions that came close to offering sanctuary for immigrants.[127] Some faculty launched online petitions calling for further resistance to ICE, including at Oberlin College and the University of Illinois at Urbana-Champaign.[128] Fifty American colleges and universities joined a brief in favor of supporting DACA students.[129] Others publicly criticized the new administration's ban on immigrants from seven majority-Islamic nations.[130] Several scientists working within the federal government took to Twitter to criticize the administration.[131] As of summer 2018 many academics were organizing to help the Democratic Party win a majority in the House of Representative during the midterm elections. All of these actions coincide with, and can be reinforced by, the present wave of student activism on sex, gender, and racial issues. They can and have elicited reaction from Trump allies, as when a Georgia legislator threatened to cut Emory University's funding if it became a sanctuary for undocumented immigrants.[132]

Will this academic resistance to Trump expand beyond the present level of activity? We can draw on American higher education history and current politics to imagine some possibilities. Teach-ins,

first held in response to the Vietnam War during the 1960s, are one antecedent. Divestment campaigns aimed at businesses associated with the Trump administration, such as those working with ICE or military suppliers, could echo prior divestment campaigns against South Africa or businesses contributing to climate change.[133] Would members of a campus community organize to block a campus raid by ICE agents? Would campus information professionals (IT and library) resist federal data-gathering requests?

Financing Higher Education

Perhaps the most controversial trend in American higher education concerns how that education is paid for. On the one hand, published tuition rates have risen faster than inflation and most other consumer goods and services has become notorious. Tuition rose following the Great Recession from 2010 to 2017, according to the College Board: "Between 2011–12 and 2016–17, published tuition and fee prices rose by 9% in the public four-year sector, by 11% at public two-year colleges, and by 13% at private nonprofit four-year institutions, after adjusting for inflation."[134] On the other hand, financing tuition through debt has become a public scandal, an object of public dread, shame, and dismay. These issues are widely discussed, especially in news and opinion media, and some of the reality is well known. As a US Federal Reserve report put it, "Between 2001 and 2016, the real amount of student debt owed by American households more than tripled, from about $340 billion to more than $1.3 trillion. The increase largely reflects an acceleration in student loan originations that was mainly due to a surge in college enrollment and ongoing increases in real tuition levels."[135]

The causes of rising tuition—that is, published tuition, not what students actually pay—are fairly well established, although they vary between institutions depending on their type and model. Robert Archibald and David Feldman have shown that universities' largest cost area, human compensation, has risen dramatically owing to the American economy's tendency to pay more for highly educated

workers, pointing to high fees for surgeons and lawyers as evidence. Archibald and Feldman add that the work of these highly trained professions is not easily subjected to automation or improvements by scale. This is known as Baumol's cost disease, wherein speeding up operations seriously reduces quality. In other words, teaching more students, as American higher education has been doing since the early 1980s, requires hiring more instructions and therefore pushes up costs.[136]

Other commentators, such as Chris Newfield, have drawn attention to state governments defunding public higher education as a major factor in elevating tuition, as public universities turned to families and financial institutions to make up for what legislatures failed to provide. This decline in investment occurred while the same states encouraged greater enrollment in their public colleges and universities. Although there has been some reconstruction of state spending on public higher education since the Great Recession's depth, "increasing by 23 percent, on average, between 2012 and 2016," according to data from the Institute for College Access and Success, support remains historically low.[137] Average support dropped 28 percent from 2007 to 2013.[138] One large state, California, tied increasing financial support to public universities' shifting class spots away from out-of-state students and toward local students.[139]

Other explanations receive varying degrees of support, including the amenities arms race whereby campuses constantly upgrade their on-site experience with ever more lavish residence halls, cafeterias, climbing walls, and lazy rivers. Some claim that rapidly escalating medical and retirement costs have pushed faculty and staff compensation to extraordinary levels and hence drive tuition ever higher. There is evidence for this claim. In 2013, Penn State administrators instituted new measures to control medical costs, resulting in faculty protests.[140] Labor negotiations broke down for several Vermont colleges over plans to have staff pay a larger share of health care premiums.[141]

Debt is unevenly distributed among Americans. Women suffer worse than men, on average, owing to compensation gaps.[142] Student

debt falls most heavily on the poor, as according to a recent analysis that found that "over half of all student debt is held by households whose net worth is under $8,500."[143] Black and Latinx people hold more debt than those of other races: "The student debt crisis is a profound policy failure for everyone, but denying its existence is a particular injustice to racial minorities who have borne the brunt of that failure, as they previously did of the housing bubble and its deflation in the 2000s."[144] While younger generations tend to bear the balance of fresh debt, debt is working its way up age brackets. According to a 2017 report, "the number of consumers age 60 and older with student loan debt has quadrupled over the last decade in the United States, and the average amount they owe has also dramatically increased."[145]

The specter of debt, exacerbated to some degree by reporting, has driven many responses, which in turn can constitute their own trends. For one, some families, especially the wealthiest, have made decisions to pay less for college over the past decade, according to Sallie Mae.[146] Some are "choosing less expensive schools and finding more economical ways for students to attend [such as] students . . . living at home."[147] For another, some businesses have decided to increase investments in their workers' postsecondary education. Several large companies, including Amazon and Disney, have offered tuition grants to their workers, occasionally in collaboration with academic entities.[148]

Concerns over student debt have given rise to a desire for reduced or supported tuition, which in turn has escalated in some quarters to a call for simply making tuition free. There is a progressive or left-wing politics to this approach, as calls for tuition and student debt reduction came from supporters of the Occupy Wall Street movement, Senator Bernie Sanders, and President Barack Obama.[149] In its last year the Obama administration (at times represented by Vice President Joe Biden and his community college–teaching wife) urged more states to consider free community college tuition programs.[150] "The President conveyed a brief but forceful message to the nation's col-

leges and universities: 'You're on notice . . . If you can't stop tuition from going up, the funding you get from taxpayers will go down,' Obama said, drawing immediate applause. 'Higher education can't be a luxury—it's an economic imperative that every family in America should be able to afford.'" Free or reduced tuition is not entirely a Democratic cause, as public tuition guarantees have been issued in red states as well as blue ones.[151] New York's private colleges and universities are seeing recent enrollment declines, driven in part by competition from that state's new public university tuition scholarship.[152] Kentucky's governor ordered all public colleges and universities to cut spending by 4.5 percent, prompting the state's attorney general to sue him.[153]

Colleges and universities have responded to the debt crisis in many ways. Some institutions have publicly cut tuition on their own, in part to attract more students.[154] For example, in 2013 Converse College announced a 43 percent cut to its published tuition.[155] Ashland University "cut its advertised tuition price by 37 percent in fall 2014 to $18,908 from $30,064."[156]

A broader response involves budget cuts with an eye toward controlling overall costs. There are many examples of this strategy, enough to constitute a major trend for American higher education. Bob Jones University cut staff and expenses after cost overruns. The University of Rochester announced an end to free tuition for staff and faculty children. Earlham College issued cuts in the face of a persistent deficit.[157] Morehouse College cut staff.[158] The University of Akron announced plans to terminate "80 degree programs, about 20 percent of what it now offers." The rationale was that those programs "suffered low enrollment or were duplicates of prosperous programs at other, similar institutions."[159] Chicago State University laid off one-third of its staff, while the University of California, Berkeley, announced plans to lay off 6 percent of its support staff.[160] Chicago State University laid off one-third of its staff.[161] Oklahoma considered further cuts to its public colleges and universities.[162]

The Decline of For-Profit Higher Education

Perhaps the most drastic cuts in higher education over the past decade have been in the for-profit sector, which saw many of its colleges and universities close after nearly a generation of rapid growth. Regulatory pressure from the Obama administration combined with growing reputational problems to sap enrollment from these entirely revenue-driven enterprises.[163] Some institutions filed for bankruptcy, while others, like a for-profit technical college in Missouri, closed—without notifying their students.[164] A New Jersey court allowed two students to sue their for-profit university, despite signing an agreement binding them to arbitration.[165]

Weaker Trends, or Trends That Went Nowhere

Anyone doing professional forecasting must be honest about their errors and misfires. Examining these lets one correct approaches, identify blind spots, and hone practice. We seek to improve our skills and understanding by looking back at how we looked ahead. For example, Phil Tetlock has built a useful short-term prediction methodology on this theme, teaching people to improve their predictive abilities by checking and rechecking what they got wrong. Tetlock's iterative method is based on political forecasting, but it is generally applicable. I am unaware of any applications currently at work in higher education, and perhaps that is a shortfall to be remedied. But applying it in depth is beyond the scope of this present book.[166]

A forecast can err most obviously when it describes a clear outcome, such as a stock value's direction or an election result, and reality turns out quite differently. A recent and vivid example of this disconnect is the confident prediction of a Clinton victory in 2016's presidential election. Similarly, a forecast can fail when it augurs continuity and stability and then is blindsided by sudden change. The collapse of the Soviet Union, the September 11 attacks, and the 2008 financial crisis are just several recent and well-known black swan–level instances of catching out geopolitical analysts and economists.

Trends analyses can misfire along either of these lines, or in an interzone between the two. A trend that looks significant can fizzle or simply take more time to realize than first anticipated. This is often the case in technology. While the digital world can race ahead, famously, it can also dawdle. E-books first appeared in the early 1980s after initial experiments in the 1970s (Project Gutenberg dates to 1971), but it took decades and many different experiments (Palm Pilot, Rocketbook) before Amazon's Kindle suddenly transformed the world of reading. Virtual reality is a major trend as of this writing, with great potential to reshape computing and some of the world (see chap. 5), but VR first appeared with world-transforming potential in the mid-1990s, only to flop. We can think of these as weak or attenuated trends. Understanding them yields additional insights into their domains, as well as the mechanisms of change.

My most erroneous forecast concerned college athletics. For years I explored the possibility that American higher education would reduce its investment in sports. While this may sound wildly counterintuitive to some readers, there was a great deal of evidence in its favor, starting with a string of scandals. Penn State had a major sexual assault case involving the highest ranks of its football program. The University of North Carolina and Florida State University each experienced widespread cheating. An unethical gifts debacle hit the University of Miami. Jim Duderstadt, then president of the University of Michigan (home of leading football and basketball teams), told one audience in 2011 that college sports were "a beast that must be tamed."[167]

Paralleling these scandals was the fact that colleges and universities struggled to cope with the 2008 financial crash and its aftermath. Many faced (and some continue today) financial problems, including cash flow crises, as noted elsewhere in this chapter and in chapter 7. Since the supermajority of college sports don't make a profit, as Bowen and Schulman conclusively demonstrated—indeed, a great many simply lose money—it seemed plausible that some campuses might cut back on football and other expensive sports to save money

for more mission-critical funding needs: faculty and support staff compensation, student life, and student aid.[168]

Sadly for my forecasting record, the historical record proved otherwise. College sports did not get cut, and instead have continued to be well funded. Their budgets have in fact increased, on average outpacing the growth of institutions' total spending. Coaches' salaries grew more rapidly than faculty's, even during the Great Recession's depths.[169] A Delta Cost study concluded that "the most significant economic slowdown in recent years has done little to reverse the growth in athletic spending, particularly in those divisions heavily dependent on institutional support . . . The growth in athletic spending is not expected to abate anytime soon."[170] From 2012 to 2013 alone, salaries for coaches at major university athletics programs increased 10 percent, representing growth of "90 percent since 2006."[171] A 2013 survey of campus chief financial officers (CFOs) found that only 18 percent even considered reducing athletics budgets.[172] The National Collegiate Athletic Association (NCAA) is doing well financially, although members have complained about costs and revenue.[173] Televised college football scored high ratings for the playoff season, "the largest audience in the history of cable television," according to one reporter.[174] The state of Utah gave extra funding to Utah State University's sports programs, apparently in response to the effects of new NCAA rules.[175] The University of Alabama at Birmingham resurrected its football and other teams, following a surge in popular contributions and support in the wake of a decision to terminate them.[176]

Scandals turned out to be survivable for many people and organizations involved. The NCAA decided not to sanction the University of North Carolina at Chapel Hill for its sports-oriented bogus classes.[177] A 2015 investigation by ESPN revealed that student athletes at two universities who were accused of crimes while studying and playing were far less likely to be charged or documented than their noncollegiate peers.[178]

What does this futuring error reveal? First, the persistence of sports funding even during extraordinary financial stresses and scandal points

to the real depths of support that American college sports enjoy.[179] That support goes beyond questions of economics, although many boosters celebrate the (rare) ability of teams to win money for their hosts (recall Schulman and Bowen's findings). Many campus leaders and external stakeholders, such as alumni, community members, political leaders, and the public in general, love student athletes for reasons of institutional identity and enjoyment of sports in general.

Second, different institutional strategies were (and remain) in play. Some academic leaders support sports in order to attract male applicants as female student numbers rise. These leaders seek what they consider a kind of gender parity. Others view athletic scholarships as a way to attract and support minority students. Taken together these underpinnings of college sports seem durable and therefore likely to power continued numbers of student athletes into the medium-term future.

In the long term, college sports may face a new pressure in the form of concussion fears. Concerns about football and brain damage have largely focused on professional players, but they are also starting to affect secondary school athletics. It may be that fewer high school football players narrows the pipeline into college, yielding small undergraduate gridiron-ready populations. Over time we could also see university populations become anxious about cranial trauma and push to change or reduce the sport. New scandals and stories of abuse, such as the death of University of Maryland football player Jordan McNair, could serve as flashpoints for broader changes.[180]

While I misunderstood what I thought of as a declining college sports trend, I also overestimated the chance that campuses would energetically increase collaboration. Evidence for this ill-starred forecast included the financial benefits of interinstitutional relationships, especially those achieved by increased scale (larger numbers for joint purchasing, for example). Multiple institutions can combine for disaster resiliency, as with the LOCKSS (Lots Of Copies Keep Stuff Safe) Program, whereby campuses share critical data so that it can be recovered in an emergency. There are professional development

benefits as well, since staff and faculty can more easily share experiences and information. Additionally, interinstitutional teaching affords opportunities to expand curricula, as has been seen in the Council for Independent Colleges humanities seminars, which let participating colleges access classes they might not have otherwise offered. Such teaching can also expand students' experience by connecting them with peers at other institutions (see chap. 16). Finally, the economic havoc wrought by the 2008 financial crash seemed likely to drive stressed campuses to more sharing of resources and strategy.

Generally speaking, however, this hasn't proven to be the case. In reality, colleges and universities have a hard time collaborating. They tend to see each other as competitors rather than allies, a perception likely to strengthen as demographic and economic pressures mount. Many campuses find partnering with businesses easier than collaborating with each other. Federal antitrust pressure in the 1980s offered some discouragement, as have a series of related national rulings against cooperation when deemed collusion. In 2013 an exploratory discussion of interinstitutional collaboration on tuition discounting elicited a Department of Justice warning about price collusion, dampening interinstitutional shared interests.[181]

The bureaucratic and political complexity of setting up and maintaining partnerships can be considerable, as multiple issues arise: different institutional scheduling systems, competing software, legal challenges. Local political problems can hamstring outreach, as offices and individual professionals who approach other institutions in a collaborative effort find themselves charged with diverting scant resources to help rival campuses rather than their own university. A certain inertia further challenges collaboration, as a dearth of good examples means a lack of cases to use for inspiration and best practices. The failure of the State University of New York (SUNY) system to implement closer intercampus connections under the "systemness" banner may have cautioned other efforts. Further, the Great Recession drove many institutions to turn inward to focus upon their strengths, retrenching

rather than reaching out. In short, interinstitutional collaboration can appear to be costly, and its benefits obscure.

Interinstitutional collaboration may grow, just more slowly than I expected. Projects may start small or proceed quietly, taking time to build structures of trust and reliability. Stealth mode could well be preferable to publicity for political reasons. Meanwhile, state systems or governments, facing funding issues and popular concerns over academic costs, may increasingly encourage their multiple units to act as one, even to the point of merging.

We can close this discussion of weak or attenuated trends with a discussion of campus anxiety about executive compensation. Faculty and staff criticism of upper-level pay has been a feature of American academia since the rise of professional administration in the twentieth century's second half, and most likely predates it, but the critique has taken a different complexion in recent years. Media coverage of such criticism has appeared in the academic and general press as income inequality has risen and as campuses grapple with financial stresses. The difference between a vice president's compensation and the often miserable pay dealt to adjuncts can motivate outrage, as can stories of plush presidential situations when compared to the rising debt burden carried by students. Examples are not difficult to obtain. A scandal erupted at New York University in reaction to news that the campus had offered vacation homes to star faculty and administrators.[182] Texas A&M's president retired with a "golden parachute" large enough to spark campus controversy.[183] The University of Pennsylvania's president elicited media attention by receiving a salary raise to over $2 million per year.[184] St. Mary's College in Maryland considered a proposal to "limit the president's salary to no more than 10 times the salary of the lowest-paid full-time staffer."[185] Washington State University faculty called for cuts to administrator salaries in order to address budget problems.[186] Faculty and outsiders criticized the University of California for a lavish payment to a former system president.[187] Illinois state legislators published a report

calling for scaling back campus leaders' compensation.[188] New York University faculty criticized campus leaders for overcharging students and overcompensating themselves.[189]

Yet for all these instances of outrage, senior administrator compensation continues to rise. Most protests win either a token compensation decrement or a slight policy adjustment, or achieve no effect at all. Boards of private institutions and state legislatures presiding over public ones appear to be secure in their compensation strategies. It may be that they follow the corporate world's logic of having to pay more for talented leaders, or that they accept the reality of rising income inequality. It may also be that outraged faculty members have generally not assembled political coalitions effective enough to alter leadership pay. In the meantime, it seems likely that while protests may crop up, their targets will continue to enjoy elevated compensation, unless a cultural shift appears and arranges a new settlement.

* * *

Taken together these education trends suggest several possible futures for American postsecondary institutions. Several seem to forecast fairly stable outcomes, such as continued adjunctification, high levels of support for athletics, rising efforts to address uneven access for underrepresented racial minorities, and growing student debt. Libraries appear likely to continue experimenting with new services while expanding their digital presence. The student body should continue to be majority female, with rising participation from first-generation students, nonwhite minorities, veterans, and people with learning disabilities. Some of these trends may extend for the short and even medium term, then reach a limit: the decline of law school enrollment, for example, or state governments' general reduction in support for public universities, or the pattern of students enrolling more in STEM, business, and allied health, and less in the humanities. Those trends could bottom out, reaching a new equilibrium, or eventually reverse.

Other trends are more unpredictable. Will American colleges and universities follow globalization and become more internationally networked, or will they track conservative nationalism and head toward some kind of academic autarky? Will academic resistance to the Trump administration escalate to open struggle? The for-profit sector's collapse may continue to play out for years, leaving it in a marginal position, or a combination of business interests and Republican political support may resuscitate the sector.

The topic of inequality recurs throughout these trends, and chapter 3 focuses closely on its economic dimension. Changes in population behavior have similarly underpinned this discussion; demographics will also play a major role.

3 The New Age of Fewer Children and More Inequality

Any education enterprise develops within the society that houses it. This is evident enough to be a truism, yet many discussions of how colleges change over time pay too little attention to the external forces that play upon them. In this chapter I focus on two large social domains that contain crucial trends for postsecondary education: demographics and macroeconomics. Their complexity and potential impacts are great enough to require a full chapter for their combined coverage.

Demographics

The past two generations, roughly since 1970, have seen extraordinary transformations in human demography. I use the word "extraordinary" advisedly, as these changes not only represent powerful shifts in human lives, but also break dramatically with the broader run of history.

Generally speaking, until the twentieth century and the onset of what some call modernity, many human societies developed in roughly similar demographic lines: few elders, a somewhat large number of middle-aged adults, more teens, and still more children. Women gave birth to many babies, a population that experienced regular morbidity; in Neal Stephenson's memorable phrase, humans were busily "spamming their environments with rough copies of themselves."[1] From infant mortality to childhood diseases to deaths by accident and war, any given birth cohort shrank steadily over time, progressively

eroded by mortality. Variations in local medical understandings, climate, relative levels of violence, and so on could adjust this pattern, but not by that much. The population arc of much of history consisted of a sizable crop of infants leading ultimately and inexorably to a relatively tiny elder population. This is the demographic power behind the high cultural valuation that elders had in many traditional societies; in economic terms, scarcity led to increased value.

Modernity shattered this ancient demography in several ways. The twentieth century's tremendous medical strides reduced morbidity rates for all age cohorts. Penicillin, antibiotics, anesthetics, blood typing, X-ray imaging, and a vast new pharmacopeia were among the many ways to cure illnesses and survive accidents that formerly decimated populations. Improved public health infrastructures and awareness carried new medical practices and technologies throughout entire societies, further expanding our ability to avoid deadly challenges. A series of agricultural innovations culminating in the Green Revolution (starting in 1950) yielded a bumper crop of food and human survivability alike (although the distribution of both remains uneven). Greater access to family planning information and practices and birth control technologies allowed women to have fewer children than their predecessors. As a result of modernity's attack on morbidity, the average and median ages of the population began to rise, as did the average age at death. One of the most dramatic measures of this epochal change is the total population size. As of this writing the world's population stands at about 7.5 billion people, more than the earth has ever borne. And that number continues to rise.[2]

Beyond medical science and agricultural revolutions, education played a central and perhaps underappreciated role in this historical triumph. Universities worldwide nurtured medical progress, from medical schools and specialized programs for nursing, radiology, and more. The apparatus of scholarly publication that arose in the wake of the scientific revolution, from peer-reviewed journals to scholarly societies, enabled researchers to collaborate at a distance and rendered

broad access to medical breakthroughs. The expansion of access to public primary and secondary school drove improvements to public health. Childbirth rates also dropped as a result of education; women were having fewer children as they gained more education. In short, for developed societies, modern education reduced the number of children while helping adults lead longer and healthier lives. Put starkly, colleges and universities have advanced the median age of the populations associated with them.

Now, after years of these historical chances, developed nations present remarkably different profiles from their historical antecedents, as well as from many of their developing nation contemporaries. The same pattern applies to uneven development within larger nations. Postmodernity populations live longer, have higher median ages, and their young people occupy a smaller proportion of their societies than do those of historical and developing nations. A typical way of graphically visualizing these differences displays an overall population by representing age-based cohorts as horizontal layers, with the lowest band representing the youngest age (such as one to four years old) and the highest band representing the eldest (for example, eight-five years and older). In these representations traditional societies appear as demographic pyramids, showing a tiny senior age layer on top of a slightly larger group in their fifties above a larger one in their forties and so on, down to a broad swathe of infants. In modernity, such pyramids look more like rectangles as median ages rise, revealing roughly equal populations at all ages. As this developmental process continues, some populations, like that of Japan, now appear as inverse pyramids, with relatively small numbers of children outnumbered by teens, who are then exceeded by various middle-age bands, and elders larger than them all.[3]

As a result of these population changes, many of these demographically transformed nations now struggle to craft policies to address their altered societies. Demographics are arguably a root cause for political efforts to revise social safety net policies through their ex-

Changing American demographics, 2010–17. Note the differences with the classic population pyramid and the smaller population under age twenty. *Source:* "U.S. and World Population Clock," US Census Bureau, December 11, 2018, https://www.census.gov/popclock/

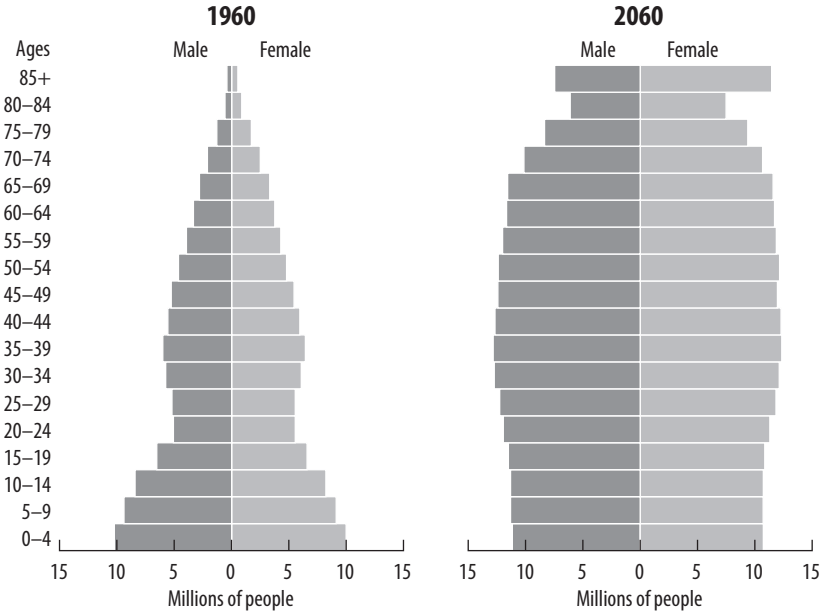
pansion or contraction, notably health care for aging populations (since the older we are, the more health care we tend to consume, statistically) and financial support for seniors (through pensions and other support programs). The United States has seen persistent legislative struggles over state and federal funding for public pensions, Social Security, Medicare, and Medicaid, partly because of this demographic transition. Perhaps the most dramatic example of policy responses to an aging population has occurred in China. After a generation of severe population control through its one-child policy on top of rapid economic growth, the median age of that nation is rising

rapidly. In response, government and party authorities have floated ideas aimed at encouraging families to birth more, rather than fewer, children.[4]

In contrast, the developing world struggles with a "youth bulge," which has opposite implications: finding jobs for large numbers of young people, growing sufficient social services, making political space for a rising generation, or resisting that space fiercely. In educational terms, financing quality primary and secondary school while growing access to and quality of college and university education is often a major challenge. Africa in particular seems to be leading the world in producing children. Its total population growth is occurring more rapidly than in recent estimations, either tripling or quadrupling by 2100.[5] At the largest level of analysis, we may be facing a dynamic between an aging "global north" and a youthful "global south."

Meanwhile, the United States has represented a somewhat distinct form of the established developed nation demographic transformation. Our median ages have risen in line with modernity's pattern, but until recently immigration has checked that rise, as immigrants tended to be younger than the rest of the population. Yet the 2008 financial crash, subsequent recession, and following weak recovery caused a "birth dearth," as many adults chose not to reproduce for economic reasons. By 2012 America's birth rate fell to its lowest level since 1920.[6] While American culture has traditionally emphasized its youthfulness, that culture may well change as the population's age advances. Within a generation seniors will outnumber minors: "older people are projected to outnumber children for the first time in U.S. history," said Jonathan Vespa, a demographer with the US Census Bureau. "By 2035, there will be 78.0 million people 65 years and older compared to 76.7 million (previously 76.4 million) under the age of 18."[7]

America differs from other developed nations in another way. Its ethnic majority, Caucasians, have long enjoyed higher health standards and life expectancies than people from other ethnicities. That difference has recently abated, as the white population's life expectancy has fallen for the first time in a generation. There are multiple



The US population, from pyramid to rectangle. *Source*: US Census Bureau, "National Population Projections, 2017," accessed April 4, 2019, https://www.census.gov/programs-surveys/popproj.html

reasons for this sudden decline, including susceptibility to opioid abuse, especially in poor rural areas; relatively high rates of suicide; and cultural reaction against the rise of other ethnicities. Princeton University economists Anne Catherine Case and Sir Angus Stewart Deaton have classified these forces as "deaths of despair."[8] It remains to be seen how much longer such deaths will persist.

That total birth rate change mentioned above is a national figure. It breaks unevenly by geography. People in Appalachia, the American Northeast, and the Midwest tend to age more rapidly than the rest. Parts of the South follow suit, while other areas, such as Florida, have younger median ages. A corridor of rising births extends north from Texas to the Dakotas, while the Pacific coastal states range from population plateaus to slow growth.

This transformation affects much of America's traditional higher education geography. The college- and university-rich Northeast is seeing its classic student population shrink, as is the Midwest, home to so many ambitious postsecondary institutions, from the Wisconsin Dream to the string of small colleges dotting Ohio. Texas and parts of the South may soon represent American higher education's center of gravity.

There are many possible ways this demographic change could unfold nationally. Some may celebrate it as a sign of long-term progress, a triumph of American science and policy. Others will proclaim it a new age for women, unshackled from mandatory child rearing. We could also see calls for more childbirth, perhaps in religious or racial terms. The politics of birth control, from abortion rights to K–12 sex education, could take on a demographic urgency, with some voices urging more births as a matter of national crisis. Several politicians and analysts have recently floated policy prescriptions aimed at encouraging American families to produce more babies.[9] Meanwhile this demographic dynamic underpins a range of policy, political, and social debates, from federal funding for Social Security to state governments' commitments to pensions and health care. Business marketing, zoning laws, K–12 funding, religious practices, immigration policies, state and city incentives to attract new people and businesses, and Hollywood casting decisions can all easily change as our population ages.

These demographic changes will have a profound impact on American higher education. Historically, this nation's postsecondary system began within that classic premodern context, as its first campuses appeared to serve those demographic pyramids. As the total population grew in the eighteenth and nineteenth centuries, so did the number of higher education institutions and their total student capacity. The creation of land grant universities through the Morrill Act (1862) and the growth of practical or "mechanical" curricula occurred in tandem with that population expansion. In the twentieth century, colleges and universities changed again in response to that period's pop-

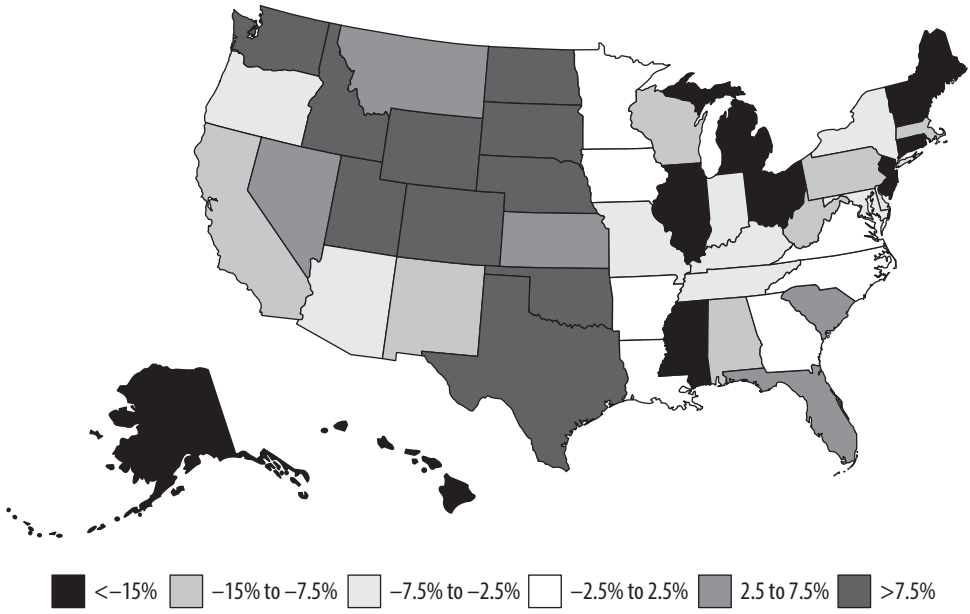
ulation shifts, expanding to meet progressive ideas of a better informed population, growing science, technology, engineering, and mathematics (STEM) capacities to meet the Cold War's challenges, and expanding again to encompass the post–World War II baby boom. The mid-twentieth century saw a series of higher education developments designed to meet these needs: veterans of the Second World War making use of the GI Bill, teachers colleges transforming into undergraduate baccalaureate institutions, the massive expansion of community colleges and state universities, the creation of federal financial aid, and the general cultural consensus around sending more Americans into some type of postsecondary experience.

Yet that broad rising curve of educational expansion has hit a demographic roadblock. The number of American high school graduates peaked in 2011 and since then has entered a long period of decline. These declines are not due to a sudden collapse of high school achievement, but to the impact of a shrinking youth population. As Nathan Grawe has pointed out, we are currently living through a slight decline in the total number of American children. This trend is going to deepen over the next decade, as the Great Recession's birth dearth results in even smaller high school populations.

The implications are clear for colleges and universities that serve traditional-age undergraduates: a shrinking market to draw from.[10]

Macroeconomic Indicators

A first glance at the global economy shows certain clear features as of this writing. Overall, economic growth proceeds across most of the world to different levels, although increases in the gross domestic product (GDP) are smaller than they were in the late twentieth century. Economic productivity growth remains positive, but at lower rates than in the 1990s. Reasons for this productivity slowdown include the rapid expansion of low-productivity jobs, a lag in realizing benefits from modern digital tools, the residual impact of the 2008 financial crisis, and a shrinking allocation of capital to workers.[11] Meanwhile, globalization continues to occur, especially in



Forecasted growth in high school graduates, 2012–32. *Source*: Nathan D. Grawe, *Demographics and the Demand for Higher Education* (Baltimore: Johns Hopkins University Press, 2018), drawn from WICHE data. Map taken from the supplemental materials, accessed July 25, 2018, https://people.carleton.edu/~ngrawe/HEDI.htm.

the form of capital flows across borders in the form of investment and purchasing. International capital movements move people, often in search of work and migrating from the countryside to cities and suburbs in epochal numbers. More people have entered the global marketplace than ever before in human history. The resulting global labor market sees manufacturing grow in some developing nations, while in the developed world, jobs transition to service. In terms of public-private sector balance, most nations support a mixed economy to varying degrees, combining private enterprise with an activist state sector that invests in defense and social services.

Within that broad picture of the global economy we can identify a series of macroeconomic trends that are working on higher education and its context. The first and largest trend concerns the histori-

cal return to higher levels of income inequality. Recent research conducted by economists such as Thomas Piketty, Emanuel Saez, and Gabriel Zucman has found that American inequality was at historically low levels between World War II and the 1980s. This represented an unusual break from the past several centuries of recorded economic history, which had seen much higher income inequality across a range of social arrangements, from land-based aristocracy to industrial capitalism.[12] Reasons for the mid-twentieth-century divergence include the massive destruction of wealth caused by two world wars, the global Great Depression of the 1930s, and redistributive national policies. The latter include the American New Deal, followed by the Great Society, and can be compared with Britain's creation of national health care or various forms of social democratic arrangements across Europe. In the United States the result was a massive reduction in income as well as wealth inequality from roughly 1945 through the late 1970s.

Starting in the early 1980s those inequalities began rising once more and have now attained levels akin to those of circa 1920. A Swiss bank, UBS, went further than the 1920 comparison and invited comparisons to the late nineteenth century, labeling our era a new Gilded Age with echoes of that period's great fortunes and business empires, or of the robber barons: "We have looked back over the latter half of what we call a second 'Gilded Age' and found that 917 self-made billionaires have created fortunes of more than US$3.6 trillion in this period. Along the way, they have driven the development of the internet and its ecosystems, perhaps the greatest innovation of our time, led Asia's consumer products revolution, and developed Asia's factories, infrastructure and real estate. They have also set up some of the hedge and private equity funds that have revolutionized finance."[13]

Many data points bear out the new inequality. The 2018 World Inequality Report found that the upper 1 percent of Americans ranked by income brought in 20 percent of the nation's income, while the lowest 50 percent took in just 13 percent. As of this writing American

income and wealth inequality continue to grow, albeit unevenly by geography.[14]

Reasons for this return to historic inequality are varied and often contentious, both politically as well as in academic research. Globalization may have driven inequality's rise in the United States as well as other nations in the Organisation for Economic Co-operation and Development (OECD), as the offshoring of manufacturing jobs, which once fueled the growth of these nations' middle classes, led to a growing gap between those working at lower-paying service jobs and those in management and ownership positions. World Bank economist Branko Milanovich has argued that OECD countries' middle classes paid a long-term price for the recent rise of the developed world, a good proportion of which has taken on those outsourced manufacturing jobs and levered hundreds of millions up from poverty. Put another way, globalization enabled greater cross-border capital flows, which enabled businesses to reduce worker compensation by shifting production to nations with lower wage expectations.[15]

The shift from manufacturing to service may have propelled inequality by another mechanism. After the 1970s the American labor force retreated from manufacturing (not the economy, which continued to manufacture products; it was the number of workers that shrank, not output) and the financial services sector grew. Deregulation in the 1980s accelerated that industry's rise, in parallel with Britain's "Big Bang" (1986). Through the 1990s the financial sector grew as a proportion of national GDP, with a steady stream of new financial instruments. Some businesses shifted investment from production to finance. General Motors was one of the more visible practitioners of this strategy, as their financial wing, GMAC, eventually generated more revenue than GM's car sales.[16] We can think of financial services' rapid ascent in terms of an overall financialization of the American economy, so large a role did it grow to play. This financial sector's success story helps explain overall inequality for the reason that finance firms rarely support a middle class. Instead, they generate large

incomes for upper-level staff, managers, and owners, all without employing many people at what would have been referred to in the mid-twentieth century as working- or middle-class salaries.[17]

We can trace the impact of escalating income inequality in several areas, which bring forth their own trends. One already alluded to is a declining sense of middle-class identity. A Pew Research survey found that the number of Americans who saw themselves as occupying the middle class was dwindling, as more people view their economic position as belonging to either the upper or lower strata.[18] Further evidence for this identification appears in more recent studies showing a significant population earning so little as to be unable to save for emergencies, in sharp contrast to an economic upper class winning ever larger compensation and wealth.[19] Former US Labor Secretary Robert Reich estimated that as many as 80 percent of Americans now live from paycheck to paycheck.[20] Compensation has generally stagnated for most jobs since the 1980s. This problem worsened following the 2008 financial crash. The economic recovery after that event has generated many jobs, but 75 percent of positions created since then pay less than $50,000 per year, and even more are contingent.[21]

Such inequality is manifest in comparing compensation between business leaders and average workers: "the average CEO of the 350 largest firms in the U.S. received $18.9 million in compensation, a 17.6 percent increase over 2016. The typical worker's compensation remained flat, rising a mere 0.3 percent. The 2017 CEO-to-worker compensation ratio of 312-to-1 was far greater than the 20-to-1 ratio in 1965 and more than five times greater than the 58-to-1 ratio in 1989."[22] These compensation gaps seem likely to persist in the medium term. The generation that entered adulthood starting in 2008 suffered depressed wages as a result of that crash and slow recovery, a drop that may strongly shape their lifetime earnings. That population as well as the group known as millennials are apparently less likely to earn more than their predecessors, a break from the generational succession pattern after the 1930s.[23]

Inequality's effects are much disputed, although research is starting to outline differences in terms of life choices and outcomes. Health inequality seems to be increasing among adults but is decreasing for children, suggesting an eventual return to health equality over the next several decades. Wealthier retirees obtain significantly more money from Social Security than do poorer ones, in part owing to the former living longer than the latter, according to new government research.[24]

Inequality is, like other economic trends, unevenly distributed. American seniors and those approaching retirement are increasingly unprepared financially for life after employment.[25] Gender and racial earnings gaps persist, although they have narrowed over time.[26]

A second macroeconomic trend describes a shrinkage in and reconfiguration of the American workforce. On the one hand unemployment has dropped to historically low levels, arguably reaching the lowest possible level, and certainly the lowest in generations.[27] On the other hand the number of people who are looking for work—the workforce participation rate—has been declining significantly since 2000.[28] President Obama's Council of Economic Advisors found that rate had fallen to 88 percent after a 1960s peak of 98 percent, outlining the problems that result: "workers at this age are at their most productive; because of this, the long-run decline has outsized implications for individual well-being as well as for broader economic growth. A large body of evidence has linked joblessness to worse economic prospects in the future, lower overall well-being and happiness, and higher mortality, as well as negative consequences for families and communities."[29] This participation decline has been especially noteworthy for men, whose rate steadily dropped from a peak of 87.4 percent in 1949 to 68.9 percent on 2018.[30]

The American labor market has changed in other ways. As noted above, the workforce continues its historical swing away from manufacturing and toward service, with barely 11 percent of workers employed in the former.[31] The proportion of American workers belonging to labor unions has declined for decades, down to 10.7 percent

in 2016, with 34.4 percent public sector workers unionized compared to a mere 6.4 percent in the private sector.[32]

Part-time work, including workers holding multiple such positions simultaneously, also known as the gig economy, has grown through the twenty-first century.[33] The proportion of Americans working as freelancers may have reached one-third of the entire labor force by 2015, and continued rising from that point.[34] Roughly 1 percent of the American workforce labors in "electronically mediated work," services facilitated by digital platforms such as Uber or Mechanical Turk, according to the US Department of Labor's Bureau of Labor Statistics.[35] It seems plausible that the shift away from full-time work toward gig labor may be connected to rising income inequality, as part-time work, which often pays less than full-time positions and usually lacks benefits, helps keep compensation low for the majority of working people.[36]

Taken together, these macroeconomic trends are likely to exert serious pressures on American postsecondary education. Some impacts are already evident, starting with income-inflected enrollment differences. A 2015 Pell Institute study of data stretching over forty-five years found that socioeconomic gaps were widening between students applying to and graduating from colleges and universities.[37] Students from wealthier backgrounds are much more likely to enroll in and complete graduate school, according to new research.[38] In contrast, students from poorer backgrounds are less likely to apply to more selective institutions, take longer to complete degrees, and are less likely to achieve those degrees than their wealthier peers.[39]

Applied to fundraising, these macroeconomic shifts are starting to change that entire field. At least one source has referred to "philanthropic plutocracy" along the lines of the massive donations seen during the Gilded Age. Increasing wealth inequality seems to be driving a greater proportion of charitable giving to come from the wealthiest population, rather than the middle classes.[40] The twenty-first century has seen a series of spectacular and at times controversial gifts

to colleges and universities from high-net-worth individuals, culminating in a $1.8 million donation to Johns Hopkins University by billionaire Michael Bloomberg. We may be experiencing the emergence of a kind of large-scale patronage system, at least for elite institutions. Should we anticipate such donors asking to play larger roles in campus governance as a fair return for their largesse?

Economic changes can trigger a different sort of politics along intergenerational lines. The likelihood of millennials earning less than their elders did at similar points in their careers and Generation Z earning even less opens up space for resentment. That resentment can hit legislatures, corporations, and nonprofits as those younger generations grow in numbers and political presence. As seniors live longer and larger numbers require more support, they may end up competing openly for resources with younger generations. It seems unlikely that canny political actors will not take advantage of these emerging dynamics.

These macro-changes can play out thoroughly at the level of individual American states. A recent Berkley report offers a useful sketch of unfolding Californian implications. Douglass and Bleemer found several forces competing within that state for public funding, starting with increasing health care costs, specifically for Medi-Cal (a health care service shared with the federal government). State pension obligations for public employees also grow as that population both expands and lives longer. The California prison and penal system has also become more expensive, in part because of a strong union influence in Sacramento; those costs increased from less than 4 percent in 1978 to nearly 9 percent of the State General Fund in 2015.[41]

We can sum up with a moment of historical framing. One reason for the stresses currently experienced by American higher education is that the system was last redesigned during the middle of the twentieth century. The 1950s and 1960s saw enormous overhauls to this nation's academics. The launch of Sputnik and the Cold War drastically expanded certain STEM fields. The Johnson administration introduced federal support for students, while during the same de-

cade community colleges grew enormously, state systems expanded, and normal or teachers' colleges became baccalaureate institutions. All of this occurred when the American economy was the least unequal it had ever been, a time with a booming middle class, a massive manufacturing sector, and high levels of union membership. The system we now inhabit is largely the creature of that time. Tracing how macroeconomic trends have created a different world over the subsequent decades helps explain the struggles campuses now face, having been designed for one time and now grappling with another.

* * *

To some extent, technology shapes these demographic and macroeconomic transformations. We have already noted how improvements in medical technology, including birth control, have helped alter life spans and fertility rates. America's shift away from employing many people in manufacturing was based in part on the rise of industrial technology in other nations as well as building capacity across national borders. Certain technology-intensive industries, such as finance, have contributed to income inequality. Silicon Valley itself has seen rapidly escalating inequality as tech firms tend to accumulate capital and allot high compensation levels to small populations. Chapter 4 explores a set of technology trends in order to obtain a clear picture of how the digital domain is changing itself and transforming the rest of the world.

4 The Marriage of Carbon and Silicon

A generation has lived through a sustained and enormous expansion in digital technology, and that rapid growth continues as of this writing. Concern about the pace of modern technological transformation began in the 1960s and 1970s in documents as varied as Alvin Toffler's futures classic *Future Shock* (1970) or the *Triple Revolution* report presented to the Lyndon Johnson administration in 1964. By the time James Gleick published *Faster* in 1999 the consensus seemed to have solidified: that we were in the midst of a complex and global digital revolution, with numerous consequences ranging from the technical to broadly reshaping civilization.

The scale and complexity of that technological development are, at the present moment, enough to occupy not just a single chapter of this book but multiple volumes, or perhaps more appropriately, alternative, more recent publication formats. This chapter focuses instead on a series of trends that either impinge directly and significantly on American higher education or reform education's immediate contexts.

Following a short explanation of each trend are supply examples and evidence from recent history and the present day. Some trends also include countervailing forces when those are significant enough. Some require greater treatment than others based on their relative novelty and complexity. Many of these trends coincide. At times those connections reinforce each other, as when the growing use of mobile

devices enables greater use of social media. At other times one can mitigate another, such as how continued security challenges breed skepticism about the Internet. These trends also connect with trends from other domains; such intersections are explored starting with chapter 7.

The Device Ecosystem Keeps Growing

The variety of computing devices has grown steadily since the days when most users relied on desktops and laptops. Mobile phones have become more prevalent worldwide, expressed by the powerful and expensive smartphone battle between Apple's iOS and Google's Android, the latter becoming the world's most popular operating system by sheer number of devices.[1] Since the iPad's 2010 release, tablet computers have proliferated as well; the iPad and iPhone cannibalized market share from the same company's iPod. E-readers initially appeared to perform the single function of making e-books available, but they gradually morphed into tablets themselves.[2] Smaller devices for personal health, such as the Fitbit, have emerged, and smartwatches have taken their place on many wrists. All of these devices have some form of networked connection to digital services, notably to social media as well as to cloud computing for content and application hosting. Google Glass and virtual reality projects have introduced a series of additions to the device ecosystem, including head-mounted displays (helmets and goggles), hand-operated controllers, and power and connectivity units worn on belts and in pockets.

The personal computer, once the digital world's dominant life form through the early 2000s, has been dethroned by this multiplying series of new devices. While PC sales fell, newer devices grew in number and market share.[3] As the PC fades, its signature interface—including the mouse, keyboard, and graphical user interfaces based on applications and content accessed through separate windows or tiles—also suffers supplementation by new forms of human–computer interaction: voice commands, screen swiping, and gestures in

the air. Relationships with other devices changed in response to the transforming ecosystem, as Americans increasingly experience television as a two-screen affair, using a second device (phone, laptop, tablet) for social media and information.[4] "For many, such as younger adults or lower-income Americans, cell phones are often a primary device for accessing online content."[5]

Virtual reality devices have added themselves to the digital ecosystem, enjoying a renaissance in that form of computation. After VR's rise in the 1980s and 1990s, a crash followed, and VR fell out of the digital mainstream for some time until its resurrection through the Oculus Rift, especially once it was purchased by Facebook. A second virtual reality wave is now under way, with rapid technological progress and initial consumer engagement. High-end devices such as the Sony Vive are on the market, while eyeglass-like mounts that hold smartphones—such as Google Cardboard—offer lower price points. The *New York Times* partnered with Google to develop content for the Cardboard platform.[6] Use cases have emerged in multiple domains, from medicine to industry to training.[7] A VR theater opened in Amsterdam, as did a Chinese VR theme park.[8]

While VR has grown so has its opposite, augmented reality (AR). Augmented reality ties various forms of digital content to the physical world. Smartphone services like Yelp and Google Maps let users download information based on their geographical content, a process enabled by increased deployment of geolocation technology. A Welsh town became "the world's first Wikipedia town," linking its built environment to the open Web using free WiFi and QR codes.[9] The America's Cup sailing race added an AR layer, combining live data sent from boats with television-displayed visualizations.[10] German surgeons used AR displays to prepare for an operation.[11] Amazon released an iOS app that models a prospective purchase superimposed in the user's home environment.[12] A Swiss invention adds an AR layer to a firefighter's facemask, displaying information through fire and smoke.[13] An interior design firm released a mixed AR/VR technology that allows users to edit, view, and inhabit a space.[14]

Virtual reality and augmented reality are essentially opposites. VR depicts an entire world in a screen or headset, perhaps with speakers, structured to replace the experience of reality around the user. AR instead maintains that external reality, then adds some small amounts of digital content to it. We can synthesize AR with VR in order to map even more digital content onto the world, by combining the former's ability to co-locate the physical and the virtual with the latter's rich media representation. That synthesis has several names as of this writing, including mixed, extended, or extreme reality. For our purposes I use the term *mixed reality*, or MR.

This technology has appeared through two major projects, HoloLens (from Microsoft) and Magic Leap. These devices consist of visors or goggles connected to portable computing hardware, and allow the user to see a mixture of the physical and virtual worlds. Magic Leap users can play a game wherein they oppose digital robots that climb over real-world furniture. HoloLens wearers can repair a mechanism with their hands, while the device superimposes images and other information over appropriate locations.[15]

As the digital ecosystem expands, so do the interfaces we use to engage with it beyond the windows paradigm and even spoken interaction. A Japanese professor created a combination of robotics, telepresence, and virtual reality, wherein a user straps on a backpack and virtual reality display. Meanwhile, a remote user shares the VR screen and operates artificial arms attached to the backpack, moving them in concert with the first user's human limbs.[16] A Canadian team produced a functioning digital scroll that can be bent, rolled, and tapped, all while displaying digital content.[17]

This ramifying device ecosystem may evolve in numerous directions. We may become accustomed to working with AR content overlaid upon increasing portions of the world, following the vision articulated in the 1990s by J. D. Spohrer. Spohrer argued that, following the Web, we would not only consume AR content but also contribute to it, perhaps in the form of a global wiki or discussion tool superimposed throughout the world, which he dubbed WorldBoard.[18]

The mixed-reality paradigm may supplant all others as we accustom ourselves to interweaving the digital and analog worlds. Or David Edgerton's vision of the persistence of old technologies may bear out again, and we spend our days moving between multiple digital devices, mostly networked, increasingly mobile, and presenting information through a dizzying array of options.

Three-Dimensional Printing Continues to Innovate and Grow

3D printing has developed rapidly, occupying a space somewhere between a document copier (perhaps known hitherto as a 2D printer) and the replicators of *Star Trek*. Humans can now print toys, food, clothing, circuitry, housing parts, rocket parts, and guns.[19] An international research effort printed replacement parts for coral reefs and then installed them on the floor of the Indian Ocean.[20] Artists printed a full-scale room weighing 11 tons and including 260 million separately detailed surfaces.[21] One manufacturer advised customers to print out replacement or supplemental parts.[22] One inventor printed car parts.[23] Another printed a functional snowboard.[24] Two Cornell scientists printed a functioning audio speaker.[25] A Boston company figured out how to 3D print in carbon fiber.[26] One research team printed objects using liquid metal.[27] A new company has scaled up 3D printers to produce rocket engines.[28] In 2016, Dubai saw the first 3D printed office building.[29] New England surgeons used 3D printing to treat a baby with an unusual life-threatening condition.[30] Princeton researchers have printed working electronic circuits.[31] The International Space Station printed a wrench, the design for which was emailed from Earth.[32] A Dutch designer has developed a project to print a bridge over a canal, using 3D printing and autonomous robots.[33] Australian researchers worked with industry to print a jet engine.[34] Disney has created a printer using cloth for its material.[35]

The medical and biological sector has seen particular innovation in 3D printing. Scots researchers have developed a printer capable

of outputting drugs.[36] English scientists have printed materials with some properties of organic tissue and even human stem cells.[37] A University of Connecticut professor invented a way to quickly administer medicine through printed plastics.[38] Doctors have successfully printed stents and tracheal splints for infants with life-threatening conditions.[39] A Spanish hospital and Australian lab collaborated to print titanium ribs and a sternum for a human patient.[40] The US Food and Drug Administration approved the first 3D printed pill.[41] Spanish researchers have developed hardware capable of producing human skin tissue.[42] Yale researchers print human tissue for transplants.[43] A dog with deformed forelegs used 3D printed prosthetics to run.[44] A Seattle start-up is printing rhinoceros horns, in order to protect the animals from poachers.[45]

The growth of 3D printing has given rise to further developments and questions. Several companies are releasing software to improve 3D object creation by letting users create and manipulate them in Web browsers without apps.[46] A 3D printed gun was successfully test-fired, sparking debates and policy changes concerning gun control and munitions export.[47] A group of students from the Massachusetts Institute of Technology published specs for scanning and printing Schlage's high-security Primus keys.[48] A leftwing city government administration in Alabama embraced 3D printing for the most marginalized citizens.[49] A 3D printed face mask was able to fool iOS facial recognition software.[50] A Canadian professor practiced and called for "critical printing," a form of "critical making" that seeks to combine hands-on technological work with conceptual study and analysis. Students and scholars can arrive at a deeper understanding of a system or device by engaging with its physical production.[51]

These challenging issues and ramifying practices suggest that 3D printing will continue to develop over the next decade. It might not reach *Star Trek* levels, but it seems to be creating a global manufacturing revolution along the way.

An End to Moore's Law?

Behind several generations of the digital revolution is the energy of continuous improvements in computer memory and processing power. Coined in 1965 to describe increasing density of transistors, Moore's Law is popularly understood to apply to the increasing power of hardware of a given size. Others consider Moore's Law to describe falling prices for digital hardware of consistent capacity. That principle has been adhered to by the entire digital world ever since, as devices shrink in size, grow in functionality, or both.

But Moore's Law might cease to apply. Theoretical physicist Michio Kaku argued that processor speed growth is showing signs of slowing owing to heat and electron leakage problems, and will stall out by 2022, yielding the post-silicon era.[52] Chip scientists are nearly at the point where they are manipulating material as small as atoms. When they hit that mark within the next five years or so, they may bump into the boundaries of how tiny semiconductors can become.[53] If these boundaries break Moore's success rate, the digital revolution may slow. Innovations may appear less frequently to the extent they rely on ever more powerful devices. Hardware manufacturers' rapid product release cycles would likewise slow.

Digital Security Threats Expanding

Challenges to information security have boomed worldwide, and examples are rampant. Concerns about election security rose sharply with reports of various Russian interventions in multiple elections, including the 2016 US presidential election. Sony was hacked by one group, possibly the North Korean government, with a large amount of privately held data leaking to the open Web. The attackers claimed it was retaliation for the film studio's release of a comedy parodying North Korea. While theaters refused to screen the movie in question, various legitimate and illegitimate online sources made it available.[54] A major vulnerability was discovered in a widely used wireless protocol. Yahoo admitted that its previously disclosed hack was larger

than announced, encompassing three billion users. The US Computer Emergency Readiness Team reported that persistent and serious attacks on physical infrastructure were under way. Russian hacking of multiple targets seems to have continued through 2018.[55] Uber reportedly paid hackers to hide traces of a massive data breach caused by another group of hackers.[56] A class-action lawsuit was filed in response to the hacking of Equifax.[57] Several hundred websites were found to track user behavior without notice.[58] Hackers gained access to four million personnel records from a major federal office, and perhaps social security numbers from others.[59] Absent a breakthrough in security protocols or technology, we should expect continuous probes and assaults on the full range of information architecture.

Social Media

In the early twenty-first century, publisher Tim O'Reilly popularized the term "Web 2.0" to describe a new way of producing and interacting with online content, one that supported greater social connections than those offered by the Web of the 1990s, as well as offering easier routes to publishing content for the average nontechnologist user. If we think back, the first years of Web-supported social interaction occurred mostly through email links and now-forgotten guest books, in addition to some discussion boards (the successors of Usenet and bulletin boards) and a rarely used wiki page. Web 2.0 added blogging, pinning, commenting, video sharing, and annotating to the mix, then built more platforms focused entirely on socialization: MySpace, Friendster, Facebook, Pinterest, Reddit, and Twitter, to name a few. The Web's new social dimension become so large that it changed the new Web's name from Web 2.0 to social media. Its adoption grew rapidly, becoming widespread in a short period. According to the Pew Internet and American Life Project, "When we first started asking about social networking sites in February 2005, just 8% of online adults said they used social networking sites." That number reached 67 percent in 2012 and 72 percent by 2013.[60] During the 2012 presidential election, "39% of American adults took

part in some sort of political activity in the context of a social networking site such as Facebook or Twitter."[61] President Obama gave a social media press conference, using Reddit's discussion and news forum to take questions from the site's users.[62] Social media started playing a role in political unrest around the world, from the Arab Spring (2010–12) to events in China, Turkey, and the United States.[63]

After one decade of Web 2.0/social media, even more iterations emerged, including mobile-focused social messaging apps like WhatsApp and Snapchat. By 2015 roughly one-third of online Americans used these apps, which are "especially popular among young adults."[64] Podcasting, a term coined in 2004, proceeded for a decade of earnest experiment and production until the surprise hit *Serial* triggered national interest in the medium. YouTube grew into what might be the world's single largest cultural archive, currently claiming that "over 1.9 billion logged-in users visit YouTube each month, and every day people watch over a billion hours of video and generate billions of views."[65]

Countervailing trends have buffeted the new Web since its start, with governments imposing various levels of content control, from the United States mandating content filters for K–12 schools to China's implementation of a massive censorship and surveillance regime popularly nicknamed "the Great Firewall." The Ugandan government levied a tax on social media use, triggering protests that were organized in part through social media, naturally.[66] The European Union urged Facebook to address fake news after that platform's role in transmitting such material worldwide.[67] The German government considered laws enabling it to fine social media platforms for transmitting hate speech.[68] YouTube faced criticism for encouraging surreal video content aimed at children, as well as for being susceptible to "deepfake" video hosting in the near future.[69] Recent research found that people were more likely to experience outrage using social media than through other media; moreover, to the extent that social media enterprises profit from increased traffic, they may be in-

centivized to encourage intense emotions in posts.[70] Two members of Congress asked the chief executive officer of Twitter to take measures against the expression of hate speech and racist organization on that platform. The Italian government promulgated a digital literacy curriculum that targets social media for spreading fake news.[71] A study found that Facebook allowed ad buyers to discriminate by race, disability, nationality, language, and other categories.[72]

Social media also faces practical limitations in its reach. Most Americans, especially older ones, cite television, rather than social media, as their main source of 2016 election news, according to Pew Research. "The digital news publishers that played prominent roles in the campaign did not appear to serve as main news sources for either Trump or Clinton voters."[73]

The leading social media platforms are scrambling to respond to these challenges. Facebook announced the development of a function where users can check whether content is sponsored by the Russian government.[74] Facebook rolled out a "disputed news" flag feature.[75] In summer 2018, Facebook took down some pages and accounts it described as being associated with an effort to undermine upcoming American elections, while experiencing a slowdown in new user growth.[76] Facebook is working with a German company to control the spread of fake news stories by users in that country.[77] Google tasked ten thousand contractors with flagging "demonstrably inaccurate information."[78] YouTube, facing criticism, announced new measures to block children from problematic content.[79] We may be seeing the emergence of a sprawling, unevenly distributed, yet universally present content control layer applied to the global Web.

The Limits of the Web

The World Wide Web's history is one of extraordinarily fast adoption and development. It is somewhat disturbing to realize how Sir Tim Berners-Lee only launched the project in the mid-1990s and did so on his own, without the support of national or multinational

governments, and to think of how much of human civilization has been transformed in the twenty-five years since. Many now take the Web for granted as part of social infrastructure, but it is vital to consider that it might not continue in that form. The Web was built upon the Internet, a network architecture dating back to the 1960s, and across which many different services have run. Most people experience the Internet through the Web, that is, through Web browsers. Yet we also engage with the Internet through many applications that do not connect to the Web, including a large number of mobile apps, gaming services, and streaming video clients. We could eventually see the Web outflanked by those parallel technologies. Rising anxieties about Web-based abuse and crime can drive users offline and into various enclosures, such as intranets or carefully controlled "walled gardens," like Apple's App Store.[80] By 2012, one study found that Americans were spending more time on mobile apps than accessing the Web through mobile device browsers.[81] At the same time government policies can discourage access to certain Web-based content or platforms. In short, while we've just lived through the Web's ascent, we should acknowledge the possibility of its future decline or eclipse.[82]

Data and Analytics

The technology world is increasingly interested in gathering and analyzing data. The US Bureau of Justice Statistics published for the first time data about nationwide police shootings.[83] An Australian academic project gathers geopolitical data in an effort to forecast genocides.[84] Researchers are exploring the use of data analytics to better anticipate people acting on suicidal tendencies.[85] Google is launching expanded apps and information for people searching for medical help.[86] The Weather Channel partnered with IBM to launch a weather-predicting tool with scales of a single city block.[87] Even as criticism about privacy and data security rises, the drive to obtain and process more data appears strong.

Fragmented Internet

The initial promise of the Internet in the 1960s was of a flat and even network, where each node could access all others. This was the ultimate vision of J. F. C. Licklider, who saw far beyond the practice of limited or military-only networks.[88] Sir Tim Berners-Lee's vision of the World Wide Web shared a similar premise, as users could navigate their browsers to any networked content.[89] The idea and policy of net neutrality expressed a similar sense of equality, with all devices able to provide equal access to the entire network of networks.[90] But that equality of access has foundered on multiple shoals, yielding instead an increasingly fragmented, even Balkanized Internet and Web. Berners-Lee argued that the experience of the Web is becoming less free and more censored.[91]

Nation-states have long held ambivalent attitudes toward the Internet. Depending on a given country and its administration, a state might value the technology's provision of educational content while disagreeing with other content carried across the network: pornography, depictions of violence, religious expressions, political statements. Nations try take advantage of open networks while supporting different degrees of surveillance and content control. Contemporary China, for example, seeks to expand Internet access for its citizens but has also created "the Great Firewall of China," a system of filters and surveillance designed to obscure certain content while alerting the authorities about related digital expressions. This firewall has challenged non-Chinese businesses and nonprofits hoping to engage with the world's most populous nation, forcing them to comply with a restricted network environment at the risk of either compromising core beliefs, generating bad publicity, or both.[92] A former Google CEO foresees the Internet splitting into two parts, with one led and shaped by China.[93]

Other nations and companies have followed their own paths to Internet fragmentation. Amazon launched an Android Web browser

aimed at users in the lower end of the digital divide, people with access only to slow bandwidth; that browser has limited functionality. Thirty countries use a Canadian firm to block a variety of digital content. A Russian court banned the Telegram messaging service.[94] Google and Facebook are deploying software to remove violent jihadist content from their video platforms.[95] Facebook is expanding, and receiving criticism about, a project to offer a restricted form of its platform to the developing world.[96] Artificial-intelligence-driven porn and violence content detection provided by a Chinese company entered American markets.[97]

Taken together, the forces driving a fragmented Internet seem likely to persist. One term suggests such a future: "splinternet."[98]

Automation's Promise

The combination of robotics and the full range of artificial intelligence (including neural networks, deep learning applications, clever algorithms, generative adversarial networks, etc.) could have a greater impact than most of the technologies we've discussed so far. Automation and in particular AI have elicited storms of controversy, with issues including the fate of humans as workers, the ethics of software, and geopolitical rivalry.

Robots have been in use for decades, mostly in manufacture, recently expanding to the rest of the world. Cleaning bots have been growing in number, from the familiar Roomba to newer machines, like Avidbots's Neo.[99] A new British invention is now competing with the Da Vinci surgical robot for use in hospitals.[100] Beyond autonomous or remotely controlled robots are robotic devices built into frames for humans to wear and benefit from: exoskeletons, once a science fiction trope, are now being used by workers in some Ford factories.[101] Chinese industry is starting to deploy robots, with potentially immense implications for that nation's economy and society.[102] A retirement community is trialing autonomous cars. An emerging industry is developing autonomous ships. Boeing invested in autonomous aircraft. Wal-Mart now uses drones to scan packages

within warehouses. Dutch scientists have successfully used robots for microsurgery. Oil industry robots known as "iron roughnecks" are increasingly at work, and the hiring of humans declines.[103] French and Portuguese vineyards have tested the use of robot grape-pickers.[104] The Chinese military has committed deeply to developing AI for combat functions.[105] A Bangladeshi restaurant elicited controversy when one of its server robots wore a scarf, suggesting that it was gendered female.[106] Automated freight transport is on the rise.[107] Ford is now testing a self-driving car in darkness and other conditions that are challenging for human drivers.[108] Dubai's leader stated that he wants one-quarter of all car rides in his country to be conducted without human drivers.[109] China is energetically developing robots for labor; one Chinese religious site now features a robot monk that interacts with visitors.[110] Robots replaced tens of thousands of workers in Chinese factories.[111] Wendy's announced it would deploy kiosks to reduce its number of workers.[112]

Of all robotic systems, drones may be the most telegenic and surprising, as uses appear from warfighting to videography and drone racing. A new project has drones deliver urgent supplies to emergency scenes.[113] Drones even figure in geopolitics and warfare, including what seems to have been an assassination attempt against a head of state.[114] A Japanese company combined drones with automated digging machines to work on a construction site.[115] By 2016 the global market for drones reached $2 billion and continues to rise, according to PricewaterhouseCoopers.[116] The Greek government started using drones to detect tax evasion.[117]

On the software side of automation, AI has spread rapidly in recent years. It falls far short of human-like general intelligence, however, typically being focused on performing a single, narrow task. Apple, Google, Microsoft, and Samsung each launched AI-powered speech recognition software. IBM launched Project Debater, software that can debate contentious issues with humans.[118] Microsoft Mandarin translation software reached parity with human translators in early 2018.[119] IBM's Watson was first deployed in a hospital in 2012,

introducing the neologism "Watsonize" and eventually assisting with cancer research.[120] Software that forecasts the location, timing, and intensity of earthquakes has proven to be quite accurate.[121] As far back as 2012, financial services firms replaced some human traders with machines, partly to save costs and partly to comply with new regulations, giving rise to high-frequency trading. By 2016, the world's largest hedge fund assigned AIs to manage trades.[122] A Google machine-learning program called AutoML learned to program other machine-learning software. Another Google program taught itself the famously deep Japanese game of Go in ways that game experts found disturbing. The software came up with moves that experts found both powerful and inhuman. One AI researcher is testing Woebot, a chatbot intended to help users cope with depression. A company is attempting to build AI inside computer chips. Russian search engine Yandex released an artificial agent. An American research team developed software that can identify individual voices out of a noisy crowd.[123] A Google Brain team trained a neural net to create doodles.[124] The Associated Press expanded its use of software for writing articles, specifically on college sports.[125] A major Swiss financial institution deployed Alexa-like AI internally.[126] Reuters is now running a program that derives important news stories for its reporters.[127] The European Parliament voted to accept a committee report urging new policies for robots and AI, including a robot registry, formal definitions of AI, setting up a European agency on the topic, and encouraging device makers to follow Asimov's Laws (the famous commands described in that writer's twentiety-century science fiction stories, designed to protect humans as well as machines).[128] Amazon announced a cloud-based AI service along with an expanded secret service for military and intelligence clients.[129] US Immigration and Customs Enforcement (ICE) put out a call for AI to assess visitors.[130] A research team developed software to recognize and even generate fashion.[131] An executive search company launched an AI-based recruitment tool.[132] A British fact-checking service launched, using automation to verify news stories.[133] A British researcher developed AI that can create new computer

games.[134] A legal app has successfully won parking ticket relief for thousands of customers.[135] Scientists have created neural networks that use facial recognition technology to identify galaxies, a process previously requiring human intelligence.[136] Skype is trialing automatic, real-time translation between English and Mandarin.[137]

As the ability to automate the creation or editing of digital content grows, so do its abuses. Spoofing Web pages and emails have been criminal tools for some time, but AI now lets users create fake audio and video clips, sometimes known as deepfakes. As of this writing software exists that can create passable imitations of famous people's voices, faces, and body language. Quality improvements to deepfakes could mean that we may face future challenges in determining the authenticity of a policymaker's public appearance, since the video evidence can be deepfaked. This development has unsurprisingly triggered a countermovement to create anti-deepfake software, including from the US Department of Defense.[138]

Automation is already starting to reshape society. Amazon warehouses, which employ robots and AI as well as humans, are cropping up across the United States A Swedish bank replaced six thousand employees with software in 2018.[139] Automated manufacturing already plays a significant part in the American economy, with leading installations in the Midwest, followed by the Northeast.[140] Foreign policy thinkers have been speculating publicly about a global AI arms race, with China and the United States in the lead (for now).[141]

In the face of so many stories of automation's progress, it is important to not assume a narrative on continuous and inevitable progress, or, more simply, to swallow hype. There is instead enough evidence to show robotics and AI running into problems that should give us caution. Uber attempted a self-driving truck enterprise, then gave it up.[142] IBM's Watson was criticized for offering medical professionals inaccurate, subpar, and even dangerous advice.[143]

Our attitudes toward automation are complex, as a century of science fiction alongside the lived experience of new devices demonstrates.[144] Humans have responded to robots with terror, delight,

ambivalence, sexual attraction, and anthropomorphization. Members of a given culture can hold contradictory ideas about automation simultaneously, as when we welcome labor-saving inventions while fearing the loss of jobs, or see robots as both adorable and terrifying. Researchers have been studying this relationship for decades, identifying concepts like the uncanny valley, wherein simulations move between eliciting a sense of welcome artifice and creating a feeling of uncanny dread. A recent German study found that when robots play audio files expressing their fear of the dark, pleading not to be turned off, some human users refuse to shut them down.[145]

If these behavioral and cultural attitudes continue, we should expect similarly varied and contradictory responses to future deployment of technologies and new forms of automation. It is possible that one attitude may grow into a position of great cultural or policy power. There are several historical examples of deliberately refusing technologies, as when Pope Innocent II banned the crossbow's use (against Christians) in the twelfth century, or when Japan's ruling elite forbid gunpowder for two centuries.[146] Although the Cold War's superpowers and some other nations built atomic weapon arsenals capable of obliterating civilization, no political actor used those weapons after 1945. At a smaller scale the Amish community has for generations refused many (but not all) industrial technologies. Imaginative literature gives us further possibilities of humans resisting technology in the form of robots and AI, as with Frank Herbert's vision of a civilization-wide "crusade against thinking machines."[147] Multiple sci-fi stories instill caution about if not active resistance to automation, like the "Slaughterbots" video imagining a combination of video surveillance and drone-driven assassination.[148] One could well imagine some such form of strong policy response emerging from today's culture: the personal dread of workplace obsolescence, building criticism of technology in general and Silicon Valley in particular, unease at economic inequality targeting technology firms.

Against these possibilities we should recall the general technology use pattern revealed by the historical record. We tend to use technol-

ogies we invent, especially those created after the first industrial age began. Opposition to technology often appears as futile, as with the failure of Britain's Luddite movement or the relatively marginal status of the Amish within American culture as a whole. Extrapolating from these examples, we can imagine people adopting and adapting to automation as we head toward the middle of the twenty-first century. We could expect some cultural opposition and regulation overlaid upon widespread deployment.

Internet of Things

Garmin partnered with Amazon to install Alexa devices in cars. Amazon released Key, a service that lets authorized delivery people enter a customer's home. Dubai announced a border security station with ambient sensors, scanning, and facial recognition. Google will build an experimental quarter in Toronto, including environmental sensors, autonomous cars, widespread connectivity, and data analytics.[149] Australian farmers are exploring the use of Internet of things devices (IoT devices are sensors connected to the cloud, displaying data through mobile device dashboards) to improve crop yields.[150] The US Food and Drug Administration approved a pill that communicates digital information to a skin patch.[151] A University of Michigan team demoed a computer smaller than a grain of rice, programmable by light beams.[152]

Security and privacy concerns run high, especially as hackers have managed to convert many IoT devices into tools for digital attacks.[153] California's legislature passed a law mandating that IoT devices be produced with "reasonable" security protections.[154] A vibrator manufacturer was found criminally liable for secretly accessing and storing user data.[155]

Blockchain

This controversial and difficult-to-understand technology has seized many imaginations since its introduction by a still-pseudonymous author, inspiring many projects and a new sector of the global

economy. The International Organization for Standardization (ISO) is developing universal blockchain standards.[156]

The most prominent blockchain product is bitcoin. After a great deal of hype and expectation about currencies that are independent of states and large banks, cryptocurrencies fell into chaos. Multiple currencies appeared, many racked by rapid price rises and collapses. Putatively decentralized bitcoins ultimately depended on key bottlenecks, such as wallets and exchanges, many of which were revealed to be vulnerable to hacking despite blockchain claims to security.[157] The US Centers for Disease Control (CDC) is exploring using blockchain for public health surveillance data.[158] Google's DeepMind is integrating artificial intelligence with blockchain for medical records.[159]

Quantum Computing

Researchers have been developing a radically new form of computing for decades, one based on the affordances of quantum physics, rather than what is now the traditional computational substrate of electron manipulation. In the latter, devices fundamentally flip electrons to one of two positions, and that binary logic underpins the entire digital world. In the quantum framework the smallest bits can be set to many more positions. If we can build devices on this basis, they can therefore be much smaller than today's hardware and accomplish more. Such computing power could, among other things, drastically increase the difficulty of breaking encryption. Furthermore, the phenomenon of quantum entanglement, by which one change in a quantum system can cause an identical *and simultaneous* change to another, no matter how far away (which Einstein referred to memorably as "spooky action at a distance"), raises the possibility of instantaneous communication, even between far removed communicators.

Quantum computing has recently moved from the theoretical and experimental realms to the practical world. A new quantum computing cloud service launched, adding a contest for the best use of the technology that demonstrates its advantages over traditional comput-

ing.[160] IBM researchers have cleared the way for expanding the quantum computer's previous limit, while launching cloud computing interfaces and services to allow users to remotely manipulate that company's quantum devices.[161] We should expect to see this field develop and expand in the short and medium term as we grapple with quantum computing's implications for information and communication.

Additional Trends

We could easily fill not only the rest of this book but also multiple volumes (in print or various digital forms) in comprehensively surveying emerging technology trends. In the interests of time, I instead close this chapter by highlighting other notable trends that are either simpler to discern than the preceding ones, currently occupy more marginal positions, or are experiencing slow growth curves.

For example, digital video continues to grow as a popular medium for both consumption and creation. Video content, consisting of videoconferencing and video-sharing services (YouTube, Netflix, Amazon, and so forth), consumes a large and growing swath of digital network activity. In 2016, one firm found that "streaming audio and video now accounts for 71% of evening traffic in North American fixed access networks. Sandvine expects this figure will reach 80% by 2020."[162] Despite many technical limitations, videoconferencing grows in popular usage, from FaceTime to Zoom to Google Hangouts. The saying "video is the new paper" suggests just how widespread and essential this technology may become.

Several trends once appeared shocking or revolutionary but have since become normalized. Cloud computing initially dazzled or threatened IT managers, since it required a new leap of trust in third parties, until we simply made that leap. Consumers took rapidly to the cloud, entrusting their photographs to Flickr, Google Photos, Facebook, and messaging services. We shared still more information to online providers beyond our direct control, from our book preferences to recipes to financial data. Enterprise IT then discovered

many efficiencies in shifting storage from locally maintained servers to those held by Amazon, Google, and others: lower costs, greater security, and new ways of running software over distributed data. Similarly, open-source software was once a crusading movement, one that divided the world into open and closed (or proprietary) code. That ideology remains, but large strata of the digital world simply run on open code, from the popular WordPress Web authoring tool to the Linux operating system.

Also, e-books went through a period of normalization, leaping from shocking commercial success (arising from Amazon's Kindle ecosystem, including hardware readers, the digital e-books themselves, and a closed marketplace for publishing and downloading them) to a staple of modern reading, for popular fiction and self-published books. While they have not replaced print books, e-books now have a secure position within the broader world of publishing and reading. A similar digital challenge confronted the hegemony of Microsoft's Office suite of productivity tools. Where once Word, PowerPoint, Excel, and their allies dominated the world of writing, presentations, and spreadsheets, Web-based versions appeared, notably in the form of Google's competing suite of Docs, Slides, and Numbers. Not so fully featured as their Microsoft competitors, the Web office movement was adopted by those with more basic needs than power users who enjoyed the lower-cost, browser-based form and simpler collaboration mechanisms. Other competitors appeared, such as the imaginative presentation tool Prezi, and the persistent wiki. As of this writing Microsoft and Web office exist in some sort of balance, much like e-books and print books.

There are several other long-standing trends that seem likely to continue this incremental growth. The vast project of digitizing the analog world continues, from libraries scanning items from their special collections to Google and Apple vying to reproduce maps and images of the entire world. Crowdfunding appears lively, from support of creative projects and creators (Kickstarter, Patreon, etc.) to social backing of people failed in many ways by America's notori-

ously flawed health care financing system (GoFundMe being the leader here).[163] Shopping continues to migrate gradually online, led most spectacularly but by no means exclusively by the behemoth Amazon, enjoying a complex relationship with analog shopping. Some consumers prefer the digital and mail order–based online world, possibly helping to speed the decline of malls, while others still use brick-and-mortar shops, which strive to compete with the digital. Some practice "showrooming," using the physical vendor as a test space for purchases ultimately performed online.

Meanwhile, battles over copyright continue, largely under the terms of the 1998 Digital Millennium Copyright Act (DMCA). Digital tools offer increasing scope for expressing human creativity while giving us more opportunities for practices that may or may not be deemed copyright violations, depending on the understanding and legal efforts of intellectual property holders and courts. Software that lets us import, edit, and export text, images, sound, and video opens us up to the possibility of legal action. Newer technologies are becoming new fronts in the copyright wars, as 3D scanning, 360-degree video capture, and the trio of augmented/virtual/mixed reality allow new ways of using or reproducing content in ways their owners might not appreciate. One reliable sign that a new technology has arrived is its inclusion in an intellectual property takedown notice. Since the US Congress demonstrates no appetite to either pass new legislation or revise the last great copyright law of 1976, we should expect further copyright and technology battles to continue.

* * *

William Gibson famously observed that "the future is already here, just unevenly distributed." This chapter provides many examples of that aphorism, as new technologies appear in different stages of emergence, from the first basic implementations to hobbyist usage to industrial scale and world transformation. Each has the capacity to alter the future of the world; naturally, American higher education's future will also be at least tweaked, if not transformed, accordingly.

Our populations use commodity technologies in their personal and professional lives. Our graduates go on to work in professions that use, and are reshaped by, these technologies. Some of our researchers participate in developing some of these hardware and software projects. And our classes use some of them to teach and learn. Chapter 5 focuses precisely on the overlap between technology and education.

5 Beyond the Virtual Learning Environment

Having considered digital and educational trends separately, we can now examine their intersection. This chapter identifies major trends in educational technology, including services currently offered by academic institutions as well as those offered externally and used by educators and students, either on their own as commodities or as part of a campus initiative.

Online Learning

The most visible form of educational technology is online learning, or what was once called distance learning. These are learning experiences occurring wholly or largely online, offered by a wide range of providers, from private research universities to for-profit firms, and using an even wider range of technologies.

Online learning's expansion into postsecondary education is one of the major stories of the past generation. Generally speaking, online learning has been growing steadily, at times dramatically, since the 1990s and the explosion of the World Wide Web. The numbers of classes and enrolled students represent a historical achievement comparable to the establishment of land grant universities in the late nineteenth century. Today, online learning is approaching parity with face-to-face learning. Clayton Christensen once predicted that the two postsecondary branches would be equal in size by 2017; while that didn't occur at that point, online seems likely to attain equivalent numbers in the medium term, as the number of online learners

continues to rise.[1] In 2016, 5.8 million students were enrolled in classes online, according to the Online Learning Consortium. The Babson Survey Research Group found a higher number, "6,359,121 who are taking at least one distance course, representing 31.6% of all students." The National Center for Education Statistics broke down online enrollment by sector: "Approximately 49 percent of the 1.4 million students enrolled at for-profit institutions were enrolled exclusively in distance education courses, as were 18 percent of the 4.1 million students enrolled at nonprofit institutions and 11 percent of the 14.7 million students enrolled at public institutions."[2] Intriguingly, "over three-quarters of students enroll at an institution within 100 miles of their home," despite the global opportunities that online learning presents.[3]

Reasons for that steady growth are multiple yet unsurprising, starting with convenience. Taking classes electronically is simply easier than traveling to campus classrooms, much less moving into a residence hall. This is a crucial difference for adult learners, who constitute a large and growing proportion of the potential student body. For many of them, managing the combined demands of work and family makes online education a more practical option. Some state governments have encouraged the creation and expansion of online learning enterprises, both at postsecondary and K–12 levels, as with the creation of the Western Governors University or, more recently, California Governor Jerry Brown's drive to build a wholly online community college for that state.[4]

There are several countervailing trends that keep online learning in check. First, access to networked technology is unevenly distributed across a persistent digital divide. Not every would-be learner can own or otherwise use the requisite hardware, networks, and software.[5] Furthermore, online learning has a reputation problem, regarded as being of lower quality than face-to-face instruction. Columbia University research found online learning to be an inferior experience for community college students.[6] A group of George Washington University faculty reached a similar conclusion, then went on to argue

that their online learning program drew students away from their face-to-face program, leading to a sustainability problem in addition to a weaker average student experience.[7] In Christensen's disruption theory, lower quality is not necessarily an obstacle to growth, since if accompanied by lower prices (as online learning often is) or other attractive features (such as convenience), people may choose it after all. Still, the sense that online classes and degrees are subpar represents a strong check on distance learning.

Many online classes resemble face-to-face classes in scale, with student numbers in the dozens or hundreds. In 2012 a new online learning movement broke that pattern. Massive open online courses (MOOCs) began by connecting with tens of thousands, then hundreds of thousands of students. MOOCs first appeared as single classes offered by individual academics, like Sebastian Thrun teaching an artificial intelligence class at Stanford and opening it to anyone on the Web, or Jim Groom unleashing his University of Mary Washington digital storytelling class across social media. With unusual rapidity for higher education, a series of universities then created their own MOOCs, either independently or collaboratively, both for-profit and nonprofit. Research universities were especially prominent in this movement, such as Harvard, Yale, and the Universities of Michigan and Texas. Udacity and edX appeared and claimed millions of students through their massive courses, taking online learning into an entirely new scale. One analysis found nearly three million American students taking MOOCs in 2012.[8] In that same year Udacity raised $15 million in venture funding.[9] More MOOC platforms emerged, as Kaplan launched KapX,[10] Stanford launched NovoEd,[11] and OpenupEd, a European MOOC platform, appeared, announcing sixty-one courses in more than a dozen languages.[12] State governments threw support to MOOCs.[13]

MOOCs rapidly became a global movement. A Finnish university admitted Coursera MOOC credit for computer science.[14] The University of British Columbia launched four science MOOCs through Coursera.[15] The French government funded its own MOOC platform,

France Université Numérique.[16] One British university's MOOCs (noted here in 2012) saw three hundred thousand students in six months: "For every student physically studying in Edinburgh, there are now ten online learners."[17] Britain also created a MOOC platform, FutureLearn.[18] Brazil launched the first Latin American MOOCs.[19] Ireland launched its first MOOC, for a business topic.[20] An Australian MOOC platform launched.[21] Indian MOOC demand seems to be growing, while edX launched a MOOC partnership with Jordan, aimed at Arab learners.[22] The Davos World Economic Forum discussed MOOCs.[23] Students worldwide signed up for MOOCs, as American students became a statistical minority.[24] The massive scale MOOCs seemed able to attain was echoed in related projects like Codeyear, Codeacademy, and the Khan Academy: Web-based learning projects that scaled up immensely, reaching more students than the largest universities.[25]

The rapidity of MOOCs' ascent was matched by the speed of their reputational downgrade. Many reports, both from within and beyond MOOC enterprises, found that while initial class numbers were immense, the number of students who actually completed classes was relatively miniscule. Several studies found that most MOOC students were people who already possessed postsecondary experience and degrees, while female, poorer, and marginal students were drastically underrepresented in those classes. So instead of increasing general access to postsecondary education, MOOCs effectively widened gaps between those with different educational backgrounds.[26] A report from the Massachusetts Institute of Technology and Harvard on MOOC usage discovered that up to 39 percent of students taking their classes were teachers.[27] In 2013, Sebastian Thrun, then CEO of Udacity, announced he would take his company away from higher education and into corporate training.[28] In 2016, Coursera launched a wholly for-pay, closed MOOC series—which isn't a MOOC, in the sense of *o*pen.[29] Along similar lines, Coursera removed some old classes from its site, taking them out of the open realm.[30] In 2014 a group of currently enrolled students in a group of seven universities

took MOOCs, but not a single one requested credit for the experience.[31] By 2017 Udacity's leaders deemed MOOCs to be "bad products."[32] In terms of Gartner Research's famous Hype Cycle, MOOCs had suffered a hype crash.

Despite their dramatic boom and bust, various providers worldwide continued to offer MOOCs. East Asian universities have continued to develop and offer MOOCs.[33] The University of Pennsylvania announced a MOOC-based master's degree in computer science with Coursera.[34] Julliard launched a series of MOOCs on the performing arts.[35] The University of Michigan partnered with edX to hold online "teach-outs" about several current political issues.[36]

Alternations to and experiments with the Stanford MOOC model kept appearing, like a British course design that called itself a SOOC, or small open online course.[37] A feminist MOOC rebranded itself as a DOCC, for distributed open collaborative course.[38] Some MOOC offerings have altered the form described in their name in other ways, notably by locking down content and therefore no longer being open. Coursera developed a way to draw revenue from its paid certification option.[39] Phonar, a British photography MOOC, emphasized open education, student-to-student interaction, and smaller class sizes. Some have dubbed that kind of class a cMOOC, where "c" stands either for Canada or connectivism, respectively the nation of origin and topic of the first MOOC, Connectivism and Connective Knowledge (2008). (That MOOC preceded Stanford's more famous artificial intelligence MOOC by three years.)[40]

MOOCs continued to expand globally. UNESCO published a guide to MOOCs aimed at developing nations.[41] The US State Department partnered with Coursera to release MOOCs aimed at refugees.[42] A growing number of voices hold that a European-specific MOOC model had emerged by 2016.[43] Georgia Tech partnered with Udacity to offer a lower-cost computer science degree via MOOC content, and with[44] edX to create another MOOC-based graduate program, this time an online master of science in analytics degree.[45] Indian company NIIT partnered with edX to expand MOOCs through

south Asia.[46] At the macrolevel the number of campuses producing MOOCs doubled over 2014, and the number of courses offered grew steadily.[47] One measure finds the total number of people who have signed up for a least one MOOC reaching 58 million in 2016, as compared to roughly 35 million in 2015. The total number of MOOCs offered also continues to rise.[48] Looking ahead, after undergoing a hype crash, MOOCs may have entered a phase akin to Gartner's "plateau of productivity," a period where they are simply used bereft of hype, and grow incrementally.

Faculty Criticizing Deployment of Technology

The massive growth of digital technology in higher education did not occur without faculty critique. Indeed, faculty resistance to technology is a persistent trend. In 2012 the union representing the majority of Britain's faculty passed a resolution warning of problems with lecture capture. Specifically targeted were concerns over forcing faculty to be recorded against their will, intellectual property, pedagogical utility, and "marketization" of the university.[49] The National Council of Teachers of English (NCTE) issued a statement objecting to the deployment of writing assessment technologies.[50] Anti-MOOC criticism appeared from leaders of the American Association of University Professors (AAUP) and National Education Association (NEA).[51] A Princeton sociologist refused to let Coursera license his MOOC for use by other campuses, citing his concern that doing so would enable state legislatures to further cut support to public institutions.[52] State University of New York (SUNY) writing faculty protested the use of MOOCs to teach college composition.[53] Eastern Michigan University faculty launched a media campaign against EMU's online learning program.[54] California community college faculty protested that state's governor's plans for an online institution.[55] Rutgers University faculty voted twice against a campus data analytics program.[56] Leading Connecticut State University system professors publicly opposed a move toward more online and blended learning.[57]

Learning Management Systems

Learning management systems (LMSs) have become enormously popular throughout higher education, often serving as the central platform for online learning. Adoption is nearly ubiquitous at the enterprise level, and a majority of classes—70.8 percent, according to the most recent Campus Computing Project report—use them.[58] At root this software creates a kind of digital classroom, with faculty members and students sharing documents and class data. (In fact, the European term for LMS accurately reflects this nature: virtual learning environment.) Although there currently exist a range of LMS providers and software configurations (open source, hosted, proprietary), the major vendors and projects perform similar functions and have done so for some time. The market is in most ways mature and could conceivably persist in this arrangement, albeit with some signal technological advances and market adjustments. For example, we can imagine an LMS rolling out functionality for Alexa-style voice-activated speakers, allowing instructors and students to verbally share class information.[59] Canvas seems to have edged out Blackboard for most widely used LMS in the United States, while Moodle still leads in the rest of the world.[60] Meanwhile, with every new iteration, Google's classroom services come closer to constituting an LMS competitor.[61]

Another path forward is the Next Generation Digital Learning Environment (NGDLE). This concept envisions reinventing the LMS from the ground up by taking advantage of certain technologies and practices that appeared after LMSs appeared in the late 1990s, such as social media and open education resources (OERs). The NGDLE could disaggregate LMS functions and distribute them across other software systems through an interoperable ecosystem.[62] As of this writing, however, such reinvention remains theoretical in terms of actual projects and products. The NGDLE may appear in the medium or long term.

Social Media in Education

While colleges and universities have anchored digital learning through LMSs, the global social media revolution has also appeared on campus. Higher education engages with this newer Web in multiple forms, often through individual initiatives as well as some campus-hosted or -facilitated instances. Instructors have taught with blogs, Facebook, Pinterest, YouTube, Slack, and nearly every platform available, seeking combinations of social connectivity with multimedia presentation and authoring.[63] Faculty have researched social media as a topic of scholarly interest, as when Clemson University researchers partnered with data analytics website FiveThirtyEight to explore millions of tweets generated by Russian agents.[64] Platform companies have reached out to academics for assistance, as Twitter recently did in an effort to decrease abuse in that space.[65] Ten British museums used Instagram to share and celebrate their collections.[66] The Europeana regional digital archive project has started hosting visual content on Pinterest.[67] A Brandeis professor used Twitter to crowdsource a syllabus on the Charleston church shooting.[68] Faculty, students, and staff at Howard University launched a mass Wikipedia edit to boost the amount and variety of black history content.[69] A clear majority of American arts institutions use social media for outreach, fundraising, and sharing content.[70] And a large and growing number of faculty use social media to share research, both within and beyond the bounds of copyright law and policy.[71]

One subtrend of academia's engagement with social media has involved staff, students, and especially faculty whose social media content enrages people beyond their campus. Examples cut across the usual political spectrum, but progressive posts seem most likely to elicit wrath.[72] Faculty without tenure drew fire by virtue of the Twitter streams. One professor's tweets about the 2012 Newtown school shootings and his university's official response triggered widespread controversy about social media, free speech, and academic culture, as did a Fresno State University's 2017 anti-Trump tweet.[73] A cam-

pus discussion about a controversial Mount Holyoke class session became more broadly discussed, once it hit social media.[74] The University of Illinois agreed to pay nearly $1 million to settle a case involving Steven Salaita, stemming from his Twitter feed; Illinois was also formally censured by the AAUP for its actions.[75] The University of Kansas president placed a tenured professor on leave because of a controversial Twitter update.[76] An Illinois campus saw continued conflict between its administration and a group of disgruntled faculty bloggers.[77] A University of Wisconsin–Madison professor elicited controversy through a series of Twitter updates.[78] A Canadian university suspended two student-athletes for obnoxious tweets.[79] One academic association considered banning journal editors from blogging.[80] A Colorado university stripped one professor of his email account after he sent a message with violent (if historically situated) rhetoric.[81] The University of Wisconsin's board of regents passed a policy allowing campuses to expel students for participating in "disruptive" protests. A Canadian university's faculty went on strike, conducting a careful social media campaign that some dubbed "digital picketing."[82] Marquette University suspended a political science professor because of a blog post criticizing a graduate student.[83] A Brandeis University student elicited controversy on and off campus with tweets about police officers.[84]

Student protests sometimes use social media for organizing and outreach purposes, as with Dartmouth campus demonstrations in 2013.[85] Upset at a new policy at their liberal arts institution, Trinity College (Connecticut) students and alumni took to a Web-based petition service to petition for a change.[86] The Black Liberation Collective uses social media to organize anti-racist actions and conversations across multiple campuses.[87] A group of Babson College students and alumni launched a social media campaign to intervene in that school's presidential search process.[88] Students and alumni from two religious colleges used Facebook to protest news of their institutions' impending merger.[89] Howard University students used the Twitter hashtag #TakeBackHU to coordinate complaints about campus

services.[90] Students frustrated with their campus responses to sexual assault increasingly turn to Twitter to complain and organize.[91] A platform that carried students' anonymous comments eventually shut down after repeated complaints about some of those comments.[92] A hashtag initially aimed at protesting Kennesaw State University advising practices became a Twitter locus for criticism of academia in general.[93] Universities are increasingly conscious of how social media grounds political discussion around their communities, but administrative responses can backfire, as when the University of California, Davis, paid consultants to try to reduce the number of Web stories about their pepper spraying of student protestors, eliciting both backlash and greater attention to the original story.[94] A state court ruled that the University of Kansas could not expel a student for Twitter posts.[95] The challenges of such social media-mediated clashes between campuses and the broader world, combined with recent concerns about online abuse, have altered some academic attitudes toward social media, leading to some programmatic responses. The University of Michigan launched a Web resource to help students cope with trolling and malware, aimed at improving their digital citizenship.[96]

It seems likely that academics will continue using social media in many forms. A fractious cultural moment encourages many faculty, staff, and students to head online for allies and opponents. Each social media platform presents different affordances based on their structure, and therefore can appeal to instructors seeking to use those forms in their teaching. Additionally, the sheer scale of the leading social media platforms suggests that they are simply where the digital action is, if one is trying to reach a given audience. At the same time, academics also play a key role in critiquing social media. Scholars like Safiya Umoja Noble, Cathy O'Neill, and Zeynep Tufekci have successfully applied their disciplinary learning to illuminate challenges and uses of these platforms. This double movement of critique and usage may well continue.[97]

Gaming in Education

Games have had a pedagogical function since leaders considered chess to be a way to learn statecraft and the Prussian officers invented *kriegsspiel* to study war. The twenty-first century has seen the computer gaming movement grow worldwide; scholars and designers like James Paul Gee and Jane McGonical have led the way in helping us understand those games' pedagogical affordances.[98] Colleges and universities steadily explore this path.

A University of Wisconsin team developed a game designed to teach adolescents empathy.[99] A contest to make STEM teaching games had four thousand entries.[100] An SRI assessment found significant improvements in learning by students using BioBeyond, a biology simulation game.[101] University of Buffalo scientists simulated human behavior during an apocalyptic event.[102] A game based on a classic American feminist Gothic story appeared, as did a historical game about the 1979 Iranian revolution.[103] Microsoft launched a Minecraft for Education initiative.[104] The American University in Cairo hosted a gaming in education event, emphasizing international and student-created games.[105] A Civilization V mod (user-built addition) offered a sarcastic and system-based commentary on the FIFA soccer scandal.[106] The New England College of Business and Finance now includes gamified modules in coursework.[107] University of Washington scientists launched a Web game to solicit creative ideas from many players for synthetic biology.[108] A historical role-playing game drew controversy over its depiction of American black slavery.[109] California State University, Northridge, now requires students to play through a sexual harassment game.[110] The Tate Modern museum published five Minecraft "worlds" to showcase selected art exhibits.[111]

At the institutional level some campuses have established academic programs in and around gaming. Utah Game Forge connects student and faculty skills, from programming to business administration.[112] The University of Texas at Austin launched the Denius-Sams Gaming

Academy, a yearlong course of study to develop gaming industry leaders.[113] A leading Canadian research university established a faculty position in digital media, learning, and games.[114] Esports, the sport of competitive game play, has achieved an academic foothold with a growing number of scholarship programs. It even has a professional group, the National Association of Collegiate Esports.[115] Some colleges have launched varsity teams for computer gaming.[116] The US Navy conducted a massive social game to surface and share ideas about that institution's future.[117]

The twenty-first century may or may not become known as the ludic century, in Eric Zimmerman's formulation.[118] Games are certainly a major culture industry. Education's varied engagement with the medium seems likely to continue.

Rise of the net.generation

For years educators have grappled with understanding the first generation to grow up immersed in the digital world, especially as millennials grew to constitute the largest generational segment of the American labor force, exceeding baby boomers, Generation Xers, and all other populations.[119] While millennials' technology skills can be overstated, age remains a strong if general predictor of social media use, with younger people more likely to use digital tools and for a greater number of purposes.[120] That tendency is complicated by other factors, especially as socioeconomic background drives different, sometimes unequal social media usage patterns for teens.[121] With that complication in mind, generational technology habit differences remain. For example, a 2016 survey on information overload attitudes finds a clear variation by age: "31% of those ages 65 and older feel information overload, while just 13% of those ages 18 to 29 report that."[122] An intergenerational gap in news sources has widened, with younger consumers preferring digital sources, while seniors tend toward television.[123] Millennials and their elders report different understandings of how that younger generation approaches work.[124]

Social and economic aspects of different generational experiences rarely receive attention in technology discussions, but they should. Millennials reaching thirty tend to have smaller incomes than their generational predecessors. They also have shifted their spending habits, allocating more money for rent, education, and health care, while paying less for entertainment, clothing, owned buildings, food, and reading.[125] Millennials' wages decreased across key industries from 2007 through 2013.[126] Millennials—especially black millennials—are much less financial secure than were baby boomers at the same stage of life, according to new research.[127] The proportion of young people living with their parents continues to rise, as the share of those living with spouses declined.[128]

The generation succeeding millennials has yet to receive a moniker, but we can refer to them for now as Generation Z. Economic stratification has affected the availability of summer jobs for Generation Z, as teens from wealthier families are likelier to win employment than those who arguably need it more.[129] In terms of technological experience, members of Gen Z appear to be even more immersed in the digital world than their millennial predecessors, so much so as to have missed earlier technologies. For example, recent Japanese research finds that while that nation's teens are deeply immersed in mobile phone culture, they are decreasingly conversant with desktop and laptop hardware and interfaces.[130] Yet Generation Z may not be the most digital generation in history. There have been many reports, think pieces, and at least one book arguing that today's teenagers may have reached a limit with their digital immersion. There are many reasons Generation Z is pulling away from screens, including fascination with retro technology, rediscovery of face-to-face socialization, fear of online abuse, and concerns that social media forces a form of inauthentic identity upon them.[131]

To reiterate, generations are enormous social constructs, massively imprecise and shot through with variety and exceptions. Yet their differences are worth attending to, as they drive different technological habits and expectations.

Big Data and Data Analytics

The generation, capture, and analysis of digitally generated data have become some of the hallmarks of our age. From the film *Moneyball* (2011) to the oft-repeated expression "data is the new oil," institutions worldwide have sought to maximize the benefits of data analytics. Higher education eventually followed suit.[132] Some colleges and universities have sought to leverage data in order to improve student learning and experience, such as by analyzing student progress through programs in order to better target interventions. Purdue University was an early adopter of this approach and reported increased graduation rates for students using a locally developed analytics tool.[133] Georgia State University created a data warehouse of student experience to shape a series of programs and interventions, especially for underserved populations.[134] The Unizin multi-university collaborative is, as of this writing, building what may be the largest data warehouse of student engagement, a difficult task involving cleaning and integrating data streams in multiple formats and at varying qualities, a process one leader refers to as "data laundry."[135]

On a different level, faculty members across the curriculum increasingly rely on data to conduct researcher. This has led some to publish data sets within or alongside scholarly articles and monographs, or even by themselves. Institutions both public and private have published data sets for research use, like Penn State's large and open data set of political events from 1979 to the present, with many uses in political science and history.[136]

While such academic work with data and data analytics has promulgated, some projects have elicited criticism. For example, a Northwestern University team studied data by and about fellow researchers collected and shared by Dropbox. But the company had not anonymized that data to the levels the researchers expected.[137] Many participants and observers have criticized privacy issues around students and data collection, especially in the K–12 world. Concerns include privacy violations, commercialization of student data, and se-

curity threats. Observers like Audrey Watters have called for students to have greater ownership of the data they generate through an institution's systems.[138] To the extent that colleges and universities can see learning and research gains stemming from data analytics, we should expect them to continue pursuing ways of collecting and understanding it.

Flipped Classroom/Blended Learning

The idea of using face-to-face classroom time for what it does best while arranging learning online for what that technology does best seems to have gained a great deal of traction. The terminology may vary (hybrid classroom, flipped classroom) and practices are diverse, from shifting lectures to the asynchronous online world to increasing exercises and student work within the physical classroom, but the general concept appears to be growing.[139] Research suggests that such hybrid or flipped classes produce better learning outcomes than either wholly offline or online classes.[140]

Automation in Education

A growing number of American colleges and universities are exploring the uses of automation. Some of this is driven by basic research, as computer scientists, roboticists, and others invest and investigate new technologies and applications. Otherwise a major motivation is using artificial intelligence (AI) to better understand student learning, and in so doing to improve a learner's progress and outcomes. Automated grading efforts are frequently piloted.[141] Businesses and business practices are emerging to retrain workers against the possibility of job automation. A Moodle developer demonstrated a chat bot built for that learning management system.[142] A Norwegian business school is experimenting with a chat bot for classroom discussion.[143] A new English-language learning service relies on AI to drive its personalized teaching approach.[144] Penn State partnered with IBM to support students exploring the use of Watson to improve student life at that institution.[145] Learning management system (LMS)

provider Blackboard developed an automatic "grading assistant" to help assess students' discussion comments.[146] Academic researchers continue to work on automating surgery.[147] Dramatically, a Georgia Tech professor convinced students that a computer program was a teaching assistant.[148] Blackboard partnered with IBM to explore using AI for campus administrative purposes.[149] Dartmouth launched its own version of the Turing test as a contest, wherein teams submit software that attempts to pass as a human being in communication.[150] Turnitin made available an automated grading service that assesses short answers and essays.[151] Rensselaer Polytechnic Institute (RPI) became the first campus site for a copy of IBM's Watson AI.[152] East Carolina University partnered with IBM to apply Watson to unstructured student data, with the goal of better organizing, then understanding that material.[153] The Chan Zuckerberg Foundation bought Meta, an AI service aimed at improving finding content in the medical research corpus.[154] In a recent trial a Chinese team consisting of university and hospital researchers created software that outperformed skilled medical professionals in offering patient diagnoses.[155] While AI's recent rise has elicited widespread criticism and anxiety, both within and beyond higher education, this wave of campus interest in automation seems likely to persist.

Campus Digital Security Threats Growing

Chapter 4 noted the rising trend of cybersecurity threats worldwide, and American higher education is not immune to this threat. For decades, colleges and universities have been prime realms for hackers to explore and exploit, and they will be likely targets in the future. Campuses are continually probed, requiring that information technology departments remain vigilant, constantly monitoring emerging challenges. Document theft, privacy violation, and ransomware attacks are just some of the attacks colleges and universities face. For example, a Brown University team found that campus devices running the Robotic Operating System (ROS) are vulnerable to external control

attempts.[156] Hackers targeted at least seventy-six universities in an attempt to copy user credentials.[157] As with the general hacking threat, this one, sadly, seems likely to continue and grow.

Educational Entrepreneurship

Through the twenty-first century, educational technology firms have generally increased their use of venture capital funding.[158] Examples are plentiful. Knewton has raised nearly $140 million through eight investment rounds.[159] Smarterer raised $1.7 million for their Web-based test-taking and registration service, and $1.1 million to InstaEDU for their tutor-to-student matchup platform.[160] Codecademy, a programming school that is like a massive open online course (MOOC) raised $10 million from investors.[161] Software company rSmart raised $10.75 million.[162] Millions of dollars also flowed from the Gates Foundation to a series of higher education projects, including new programs (MIT-Harvard's edX) and schools (University of the People).[163] LMS Canvas won a $30 million shot of investment capital.[164] StudyBlue, which generates study aids both automatically and through crowdsourcing, won $9 million from private and academic alumni sources.[165] Established online training company Lynda.com received $109 million in venture capital to expand its reach.[166] Investors sank $25 million to create Minerva University.[167] Venture capitalists gave Schoolology $6 million to compete in the higher education LMS space.[168] A French e-textbook company raised millions of dollars to launch an American expansion.[169] Bill Gates announced that he would give more than $1 billion to school projects, particularly centered around interinstitutional networks. Google set aside up to $1 billion in grants to educational projects. Apple cocreator Steve Wozniak debuted an online technology education project.[170] Incubators offered mixtures of consulting, logistical, and financial support, as with a British space for educators and entrepreneurs to explore partnerships or the Israeli Center for Educational Technology's large-scale incubation space.[171]

Like with any investment wave, this trend can become too volatile to forecast with confidence. As of this writing, we can only offer an extrapolation of continued entrepreneurial and funding activity within higher education and technology.

Open Education Possibilities

Ever since the term "open education" appeared in the 1990s, open education resources (OER) content and interest have grown, supported at times by foundations, corporations, governments, and various offices within higher education. Definitional questions vex the movement at times (Is streaming open? Does open mean free of cost?), but OER production and use as a trend continue.[172]

The Saylor Foundation opened its media archive to all, for free.[173] OpenStax saw increased usage, and it plans to launch new titles.[174] A thirteen-state OER project for community colleges commenced in 2016.[175] The European Union launched a continental open education portal.[176] The Follett textbook company partnered with open education start-up Lumen to place more OER content in bookstores. The Public Library of Science (PLOS) launched a new communication venue for scholars, called Channels. New York State announced significant support for the creation of open education materials as part of its free public university and college tuition plan. Twelve public Maryland campuses won eligibility to apply for funding to create OER materials.[177] Researchers made freely available scans of the Lucy hominid fossil.[178] Cal Poly students share open content through their library-based Open Culture Club.[179] OpenStax open textbooks are available to students through services connected to the majority of American colleges and universities.[180] Several state systems, including New Hampshire and New York, scaled up open initiatives from pilots to multicampus programs.[181] The US Department of Education published a guide to help K–12 school districts make use of OER.[182] Amazon launched an OER discovery service for educators.[183]

Different academic populations find different values in OER. Some see lower costs as vital, especially for low-income students. Others

value the greater creativity that faculty and students can exert upon open materials. Some see better academic outcomes for students using OER.[184] Wesleyan University and Bryn Mawr College reported good results in using Carnegie Mellon's Open Learning Initiative (OLI) courseware, which combined open materials with learning tools and exercises.[185]

In parallel with open education resources is the movement toward open access in scholarly publishing. This effort seeks to move research articles and monographs from behind paywalls and onto the open Web in order to reduce costs and increase access to (and participation with) the scholarly record. As with OER, open access has been supported at times by governments, academic entities, nonprofits, and so on, in addition to Wikipedia, which tends to link to open access materials.[186] Some researchers and institutions have turned to open access publication when they perceive an alignment between their content and current affairs, as when Princeton University Press published a political science monograph on the 2012 presidential election, with key chapters released early, in time for summer party conventions.[187] The Unpaywall Web browser extension appeared, which points users to open access versions of scholarly papers referenced in a given Web page.[188] German universities have organized an open access movement against major scholarly publisher Elsevier.[189] Two open access initiatives appeared from the University of California Press: "Collabra (an open access megajournal) and Luminos (open access monographs)."[190] The Association of American Universities (AAU), the Association of Research Libraries (ARL), and the Association of American University Presses (AAUP) launched the Open Access Monograph Publishing Initiative aimed at humanities scholarship.[191]

Some college and university faculty have officially backed open access, even to the point of requiring their colleagues to publish accordingly. There are financial reasons for such policies, as when even Harvard University announced that scholarly journals had become too expensive for them to support.[192] Faculty from a leading medical campus, the University of California, San Francisco, decided to

mandate open access for their scholarly publications.[193] Amherst College created an open access online scholarly publishing imprint.[194] Caltech faculty voted to require publishing their research in an on-campus pen access digital repository, unless they request a waiver.[195] The University of California system announced a pro–open access policy, directing faculty to share copies of their scholarly work with the system's Escholarship online repository.[196] Three University of California academic libraries signed on to an international agreement to make as much of their scholarly literature open access as possible.[197] A European Union meeting urged publishers and scholars to make all scholarly publication open access by 2020.[198] Indiana University–Purdue University Indianapolis included recognition of open access scholarship within faculty hiring, promotion, and tenure review processes.[199] Vice President Joe Biden launched an open access cancer research resource.[200] A coalition of European funding agencies proclaimed that they would only fund scholarly work published in open access venues, calling on all other funders to follow their Plan S.[201]

There are many countervailing forces that block universal or even majority adoption of open access and OER. Creating and publishing open content can be costly for a given researcher, department, or campus, as when the University of California, Berkeley, ended a long-running service that openly shared lecture recordings, when faced with substantial costs to make them more accessible.[202] There is a widespread perception that open access is of lower quality, even when high-quality open access materials are available. Entities with business models built upon revenue from selling learning and scholarly content, such as publishers and scholarly societies, are often reluctant to risk revenue.

Against such resistance, OER and open access have grown only incrementally. Extrapolating on the basis of that curve, absent a dramatic change, we may expect a "flip" to most learning or scholarly materials being open by the mid- to late 2020s. A dramatic upward change, such as the assemblage of a powerful pro-open coalition,

could accelerate that time line. A crisis or upsurge in negative publicity could similarly stall open's ascent.

Video and Education

Digital video has become a widely used educational technology. The majority of American instructors use digital video in their teaching, according to a new survey.[203] The majority of college and university students were watching videos as of 2015: "68% of students report that they watch videos in their classes. In addition to watching videos because they are assigned or shown during class, 79% of students voluntarily watch videos to enhance their understanding of a topic, to better understand material introduced in class."[204]

Some instructors are using video instead of text to provide feedback on student work.[205] Harvard Business School displayed a video-intensive classroom, where up to sixty separate feeds display individual students to a faculty member.[206] On a different level, colleges and universities can support students as creators of video content. Several campuses, such as the University of Georgia, host student video contests.[207]

Virtual Reality in Education

A second wave of virtual reality development has surged worldwide, as noted in chapter 4. Campuses have been exploring VR for a range of academic purposes. Case Western Reserve University is developing VR cadaver labs.[208] Washington University School of Medicine faculty developed a scheme for using VR to visualize the human heart and the cardiovascular system.[209] The Rome Reborn project, which began in the 1990s by creating 3D images of the Roman-built environment, recently added VR visualizations.[210] Harvard University produced VR representations of cultural and archaeological sites.[211] A Worcester Polytechnic Institute class used a mixed-reality approach to successfully visualize complex biological systems.[212] Penn State University is piloting a VR lab with new spatial arrangements for

headset-wearing students. A VR project to raise awareness of racially biased policing is being developed at Carnegie Mellon University.[213] East Carolina University's education department uses VR to train primary and secondary school teachers-to-be.[214]

Academic VR work has extended to mixed-reality technologies. A medical school is using Microsoft's HoloLens to visualize patients' interiors. A Worcester Polytechnic Institute professor used HoloLens to visualize complex protein molecules and the human brain.[215]

Virtual and especially mixed reality are in early days as of this writing and hence have a range of future trajectories to follow, from widespread adoption to marginal usage. Accordingly, it is difficult to forecast their academic futures. At present there is scattered interest and broader curiosity about possibilities, which should drive further experimentation.

Technological Collaboration

Interinstitutional collaboration is difficult to attempt in American higher education, but technology has helped increase its chances of success. Digital networks have added to our communicative and sharing capacities, while technological and technology-driven needs offer some of the most appealing rationales for joint action between institutions.

The Smithsonian and Internet2 (I2) signed an agreement to improve I2 institutions' access to digital objects hosted by Washington, DC–area cultural heritage institutions.[216] An Associated Colleges of the South project, the New Paradigms Initiative, piloted several intercampus blended learning classes.[217] Five Appalachian colleges and universities are going to share some faculty members using networked technologies in a Teagle Foundation-funded pilot.[218] Two SUNY system campuses, University at Albany and nearby Hudson Valley Community College, agreed to share information technology services.[219] Five Vermont institutions (including colleges, universities, and law schools) announced a collaborative food systems program.[220] Three campuses (Bucknell, Franklin and Marshall, and Susquehanna)

jointly hired an information security officer to protect against digital intrusions.[221]

Digital Humanities Develops

A digital humanities movement has grown over the past two decades. Practitioners identify, repurpose, or create technologies to explore classic humanities questions. Projects and practices include text mining and semantic analysis, social network analysis for works of fiction, and the creation of Web-based or mobile app editions of important or neglected works.

One example visually maps literary influence across nineteenth-century British novels.[222] The University of Richmond launched the Visualizing Emancipation American history project, which maps the liberation of enslaved people across space and time.[223] A Northeastern University project tracks the spread of ideas and documents across nineteenth-century America, sharing the results over the Web.[224] A Boston College project is adapting James Joyce's novel *Ulysses* to virtual reality.[225] New categories of research have emerged, like "distant reading," which analyzes masses of literary texts or historical documents. A *Journal of Digital Humanities* launched.[226] By 2013, digital humanities methods grew from graduate schools to undergraduate classrooms, according to research by the *Chronicle of Higher Education*.[227] A North Carolina State team released a Web tool for visualizing centuries of humanities scholarship.[228] Computation anthropology is emerging as a field.[229] A project combining history and big data to analyze the 1918 flu pandemic launched.[230] Recent work automates textual analysis to yield insights into language, gender, and classic novels.[231]

The digital humanities movement poses several interesting challenges to the American academy, as projects require unusual forms of interdisciplinary and interprofessional technological support and collaborations. The movement is not without detractors, both informally and in published critiques, as when a high-profile article criticized the digital humanities movement for being bad for the humanities and

enabling a neoliberal agenda in higher education.[232] Those critiques notwithstanding, digital humanities has emerged as a major trend.[233] One metric shows its scope: digital humanities took up 8 percent of all sessions of the 2013 Modern Language Association Conference.[234] Another data point: the National Endowment for the Humanities has a dedicated Office of Digital Humanities.[235]

Blockchain in Education

While bitcoin has become a global story and blockchain a signal technological innovation, there have been several academic uses. The leading implementation involves publishing credential information to a blockchain to protect it and give students greater access to it. In 2017, a class of students graduated from MIT with blockchain diplomas.[236] Another academic blockchain use involves scientific research into the technology's nature and ramification. In 2018 the government of the island nation of Malta committed to turning itself into "blockchain island," set aside €300,000 to fund local university students studying blockchain technology.[237] This trend remains small, partly because of a perception that the technology does not have a good academic fit, and partly from controversies over bitcoin. It may continue to occupy an educational technology niche moving forward.

Maker Movement

The maker movement has won interest from tinkerers, governments, and the curious, and so it should not surprise us to see academic makerspaces. Mount Holyoke College opened a pop-up media lab aimed at combining the classic media lab with the maker approach. Davidson College opened a makerspace.[238] The makers of MakerBot launched an initiative to put 3D printers into classrooms.[239] Vanderbilt University opened a makerspace in a local hospital, for use by young people in long-term care.[240] Off campus, the New York Hall of Science set up its own "Maker Space," while San Antonio's recently launched Geekdom targets local students.[241] Some Vermont

towns developed repair cafés to connect skilled people to those with challenging appliances.[242] The Children's Museum of Pittsburgh partnered with Google to build a makerspace.[243]

Many maker traits appeal to academia, including its creativity and pedagogical practice. Its emphasis on nondigital projects (fabric, wood, engines, etc.), even though digital tools are often involved, can gratify academics fearing a generation oversaturated with screens. Connections to nearby communities through skill sharing may interest campuses seeking better town–gown relations. These positive traits may carry campus maker practices forward for some time.

Three-Dimensional Printing across the Curriculum

Closely related to the maker movement is the 3D printing world, which is often supported by makerspaces. As the technology advances in capacity and grows in usage, academic instances have ramified. Initially 3D printing was the province of disciplines like engineering and computer science. It then reached other academic units for which rapid prototyping made sense, including architecture and media studies. 3D printing also connected with disciplines for which visualization was a major pedagogical issue, as when what needed to be seen by students was too small (chemistry, biology, pharmacy), too large (astronomy), or no longer exists (classic studies, history). Accordingly I refer to 3D printing throughout the curriculum as an echo of writing.

Examples stretch across institutional types. An Ithaca College undergraduate printed artificial hands.[244] University of California, San Diego, students successfully printed an engine and launched a rocket powered by it.[245] An Australian National University graduate student printed a replica of an Iron Age artifact to test its functionality as a musical instrument.[246] The Smithsonian made 3D models of some holdings freely available, allowing users to remotely print 3D copies.[247]

As 3D printing continues to grow, we should expect academic uses to follow suit. Indeed, academic research and development may help

advance the field. Several challenges help check 3D printing across the curriculum's advance, including the technology's youthful state. Devices are capable of misfiring, and supporting them on campus requires a dedicated space. Waste products require management, at least until recycling them into useable feedstock becomes widespread. We may see 3D printing settle into certain academic departments as key components of their research or teaching work.

Mobile Devices in Education

As smartphones, tablets, laptops, and other devices became central to the computing world, they also appeared in the academic world, both on and off campus. IT departments created extensive support mechanisms, from multiple Wi-Fi hotspots to help desks equipped to address the ever-growing device ecosystem. The mobile world's ability to link any user to most of the digital world has boosted access to learning while transforming the nature of institutional spaces.

There are many examples of mobile device use in higher education, but we can identify several exemplary cases. Harvard grad students used mobile phones to create high-quality maps for ecological fieldwork.[248] The Library of Congress funded a group of educational projects based on mobile devices, including topics in history and public scholarship.[249] A Stanford medical team used the Apple Watch to monitor irregular heart rhythms.[250] A Wilfrid Laurier University teaching assistant recorded a confrontation with her professor and an administrator, kicking off an international controversy.[251] St. Louis University rolled out Amazon's voice-activated Echo Dots across campus.[252]

Mobile devices have been subjected to recent criticism, mostly for their role in expanding access to problematic digital tools: social media, privacy violations, gaming, and excessive commercialism. Nonetheless, the mobile sector remains crucial to the computing world and, increasingly, to the lives of most people. It seems unlikely that aca-

demia will retreat from this engagement, but the scenario in chapter 14 envisions just such a move.

* * *

At this point we have surveyed a wide range of trends reshaping American higher education, from domains as diverse as demographics, technology, economics, and alternative certification. We will now explore combinations of these trends to see how their intersections further illuminate the future of colleges and universities.

6 Connecting the Dots: Metatrends

Having proceeded through nearly one hundred current trends across a range of domains, how can we further apply that understanding to the future of education? The most direct way is through extrapolation, simply projecting trends forward in time, then imagining their impact. We have done some of that in the preceding chapters and will return to that approach in later ones in order to construct scenarios.

We can zoom out from individual trends to see them moving in aggregate. If we assume each trend continues along its present lines—a risky assumption, since trends do not always maintain a steady progression, but one worth pursuing for a first step—a macro-picture of higher education over the next decade appears. It is one with fewer students taking classes overall, although with more attending online than at the present. Roughly one-half of those students are adults. A majority are nonwhite, and 40 percent live at or below the poverty line. Most of their class materials are available as open education resources (OER). One-fifth are from countries other than the United States. Those students are more likely to be enrolled in STEM, professional, and preprofessional programs, while the humanities, arts, and less quantitatively intensive social sciences have dwindled. A larger number of campuses no longer offer majors in many humanities fields; instead, those departments are service departments, only providing instruction for students through the core curriculum and as electives.

A supermajority of faculty members are adjuncts. The next largest category, a substantial minority, consists of full-time instructors work-

ing on multi-semester or multiyear contracts, but not on the tenure track. Tenure-track positions represent 10 percent of the total American professoriate. A significant portion of administrative time now goes to managing non-tenure-track staff. American academics publish more research in open venues, but less scholarly research overall.

Administrative staff are more numerous than they were in 2019. There are more officers and offices tasked with regulatory compliance. Student support services are massive, including research aids, disability assistance, mental health counselors, academic advisors, residence life staff, and career services. Sexual assault and harassment units are substantially resourced if unevenly so across individual institutions and regions, and include both significant legal representation and close integration with some academic programs (law, penal systems, gender studies).

Technology is more involved with education than ever before. Most classes include multimedia content. Multiple classes involve the use of 3D printing, robots, and video production. Digital materials are accessed through multiple architectures, ranging from traditional learning management systems (LMSs) to semi-LMSs and semi–social media platforms. Students, faculty, and staff generate data in their daily activities on which institutions harvest, then use them to drive assessments, assignments, promotions, reviews, and interventions. IT departments are larger and responsible for more functions as cyberattacks, devices, and applications proliferate. Some campuses offer artificial intelligence–driven instructors in certain topics, while most offer AI-backed assistants for general information. Students rely on multiple software packages to learn and faculty the same to instruct. Most classes are hybrid or flipped. AI programs help administrators manage their institutions and are rumored at times to do the real work of management. The digital humanities are the only robust sector of that branch of learning. Libraries are closely involved with some aspects of technology support.

Classrooms, dorm rooms, and offices can host more digital technology than we are used to in 2019, depending on institutional resources

and strategy. Some will include voice-activated tools, as a student enters their room to ask, "When is my next Bio exam?" or a professor asks her office, "What's the median grade of that class?" Multiple screens of various sizes display information and other content. Hardware to access virtual, augmented, and mixed reality is available, including light glasses. Multiple input systems are available, from voice to gesture to keyboards.

Campus software is more complex and ambitious than it is now. Office productivity tools appear in many forms and on diverse platforms. Software, including AI, runs across many sites to collect and analyze data from student behavior to organizational performance. Some portion of findings is published to a shared blockchain. The LMS is spread across multiple digital locations, from library collections to student recruitment and alumni affairs. It, too, contains some AI functions and is also integrated with physical locations.

Higher education is more expensive, with several universities' published tuition, fees, room and board exceeding six figures. Total student loan debt passed $2 trillion in 2026. Discount rates for first-year students average 65 percent.

There are fewer colleges and universities, especially in the Midwest and Northeast. Law schools in particular are fewer in number and smaller in size.

* * *

The above is a simple extrapolation exercise, extending many trends into the future. It does not allow for variations within given trend lines, such as their weakening or strengthening. It also does not address synergies between trends, when two or more intersect. It is a first approximation forecast.

A different way of understanding multiple trend lines is by combining or synthesizing small groups of them. At this scale, trends can reinforce or cancel each other out. A cluster may fit together into a movement or a new trend. In this chapter we examine a series of these connections. Readers are invited to generate and share their own.[1]

Connecting several trends at once can generate implications for strategic planning. If income and wealth inequality continues rising, for example, while institutional operational costs remain high or also rise, and as state support to public institutions persists at its recently established low levels, higher education may well find it prudent to focus more on the wealthiest families for financial support. This could take the form of increased reliance on charitable giving, a field where an increasing proportion of gifts comes from the wealthiest. St. John's College recently announced that they would reorient their entire business model to rely on philanthropy, steeply cutting tuition in the process.[2] Similarly, connecting demographics and technology yields certain strategic options. A regional institution that serves traditional-age students and faces a decline in the area's K–12 population may turn to online teaching in order to build enrollment, relying on the continued expansion of Internet use, access, and tools. Southern New Hampshire University offers perhaps the paradigmatic version of this, as their local audience aged more rapidly than most of the United States.

Similarly, the panoply of educational technology trends outlined in chapter 5 can constellate into a series of metatrends requiring a campus-wide approach. In aggregate it seems that campuses will continue and to some degree expand their technology investments, from data analytics to LMSs and the digital humanities. Generally this does not seem to be accompanied by significant budget increases, so such work must proceed by a mixture of relying on some commodity price decreases, growing capacities of some technologies, gradually increasing faculty technological comfort with digital services, and steadily improving IT staff innovation.[3] At the same time, faculty criticism of online learning, as well as of social media and big data, can strongly shape campus technology implementation.

Other trend clusters point to outcomes for specific education sectors. For example, numerous commentators have forecast the decline of liberal education. Declining humanities enrollment plays a key part in this projection, as does a sense of declining appeal for rural areas, where many liberal arts colleges and universities are located. To these

two we can add a model of student engagement where younger populations are more likely to think in terms of professional education, based on their experience of a troubled economy and dread of student debt. As a result we may see a reduction in student interest in liberal arts institutions.

There are some problems with this forecast. To begin, it often conflates liberal arts *colleges*, of which there are fewer than three hundred, depending on the measure, with liberal *education*, a curricular and pedagogical practice employed by a wide range of institutions, from state universities to research campuses to military academies. Often the larger campuses create small units within their system, offering a kind of embedded liberal arts college. The Association of American Colleges and Universities (AAUP), an organization devoted to the implementation of liberal education across institutional types, counts more than fourteen hundred members, more than a quarter of all of the nation's higher education sector.[4] Furthermore, this forecast often conflates the liberal arts curriculum with the humanities, ignoring how all liberal arts institutions offer courses and majors in the social and natural sciences. The liberal arts model is better understood as a multidisciplinary experience, including significant care for a learner's progress, and one that prepares a well-rounded student for a life consisting of multiple career paths and interests. Additionally, these forecasts often downplay the location of many liberal arts campuses in or near major cities, like the Claremont Colleges in Los Angeles, Barnard College in New York City, or Trinity University in San Antonio.

Those caveats aside, this metatrend challenge to liberal education is real. The rise of enrollment in science, technology, engineering, and mathematics (STEM) has come at the expense of the humanities, and sometimes in a way that focuses on scientific disciplines more than interdisciplinary study. Interest in professional degrees is rising, which can either take students away from liberal arts institutions or inspire the latter to offer enough professional work as to potentially alter their identity. A recent study found that the number of liberal arts–focused

institutions had declined since 1990, at least by two metrics: professional degrees as a proportion of degrees granted and types of majors offered.[5]

Another metatrend challenge concerns rising segregation, and starts with the persistence of structural racism aimed especially at Latinx, black, and Native American populations. To this we add escalating income and wealth inequality, which constructs separate and unequal experiences for learners of different classes. This metatrend also draws on the history of American educational inequality, from black families driven by redlining into poorer K–12 school districts to the creation of quotas aimed at restricting Jewish student numbers. It could lead to increased segmentation of students and institutions, the latter tacitly or even openly defined by which populations they prefer to admit and which to exclude.

This is not a fringe observation. The Obama administration's last secretary for education, John King Jr., expressed it in a public meeting with university presidents: "When it comes to student access, we need to acknowledge the ways in which we are becoming a caste system of colleges and universities . . . It is unjustifiable that students from the richest families make up a whopping 72 percent of the student bodies at our top colleges, whereas students from the poorest make up just 3 percent of the enrollments there. That is an embarrassment. It is a death sentence for our historic promise of social mobility."[6]

Note how this statement suggests that such a system could become self-perpetuating through its language of caste and declining social mobility. A Canadian observer, Alex Usher (of Higher Education Strategy Associates), offered a similar assessment: "I don't think there is much doubt that in America a new form of hereditary upper caste is emerging from increasingly stratified education systems."[7] It is unclear whether the general public will notice this metatrend, and then which responses will be offered, if any.

A different kind of separation may occur within the professoriate, as a deepening split between research and teaching functions. The key driver here is the adjunctification of faculty members, a process that

drastically curtails research expectation and support of part-time instructors. An additional factor is the perception that grant support for faculty research incentivizes professors to devote more time to seeking, writing, and running grants rather than to teaching; this can be heightened by cuts to professional development lines. As a result we may see a bifurcated professoriate nationwide, with one larger segment working primarily as teachers, and another smaller one focused on research. This would require downgrading interest in integrating research with teaching, including the practice of undergraduates conducting research.[8]

Other trends combine to produce a darker vision of American higher education under threat. Some commentators, like University of Tennessee College of Law professor and influential conservative blogger Glenn Reynolds, have labeled this a "higher education bubble," that is, an economic sequence of rising valuation for a certain commodity that outpaces reality, followed by a rapid decline or collapse in that value.[9] The term draws on the long history of speculation bubbles, including such extravagant boom-and-bust stories as Holland's seventeenth-century tulip craze and Britain's eighteenth-century South Sea debacle, but it has a more contemporary resonance with the dot.com crash, which peaked in 2000–2002, and the housing bubble that played so critical a role in the 2008 financial crisis. There is even (or of course) a Wikipedia page about it.[10]

The trends involved in a bubble model are fairly consistent across various accounts. Derek Thompson's description offers a good and concise example: "First, the annual growth rate of college tuition is at its lowest rate on record. Second, the annual growth rate of student debt is lower than any time in the last decade. Third, the number of college enrollees has declined for five consecutive years. Fourth, the college premium—the extra income one should expect from getting a bachelor's degree—is higher than it was in the 1990s, but it's stopped growing this century for young workers."[11] Nobel laureate Paul Krugman agrees with the recent college premium problem: "high levels of education have offered no guarantee of rising incomes—for

example, wages of recent college graduates, adjusted for inflation, have been flat for 15 years."[12] Reynolds and others of similar political persuasions add a criticism of campus politics, arguing that too strong an institutional emphasis on various fields of study and practice (feminism, anti-racism, postmodernism, and activism for lesbian, gay, bisexual, queer, and transgender rights) will ultimately drive away more students than they will attract.

Other observers do not offer the bubble model per se but instead combine similar trends to generate a likewise negative picture. Thompson sees a decline in less dramatic form than a bubble, but a decline nonetheless: "Altogether, the numbers paint a clear picture: The higher-education market is not bursting, like a popped soap bubble; but it is leaking, like a pierced balloon."[13] Michael McDonald refers to "the college contraction."[14] After the closing of one campus in 2013, Moody's warned that more college closings were likely: "The pending closure is credit negative for a small subset of the higher-education sector with similar attributes to Saint Paul's and other closed colleges: very small, private colleges with a high reliance on student charges, indistinct market positions, and limited donor support."[15]

President Obama spoke of these trends as limiting access to higher education, saying, "Over the last three decades, the cost of higher education has gone up 260 percent, at a time when family incomes have gone up about 18 percent. . . . if you've got one line going up 260 percent and another line going up 16 percent, you start getting a bigger and bigger gap. And what's happened as a consequence is that either college has become out of reach for too many people, or young people are being loaded up with more and more debt."[16]

That fear of debt combined with dread about postcollege outcomes can reach a passionate pitch. In 2016 the normally dispassionate *Consumer Reports* ran a cover story with this bold, all-caps headline: "'I KIND OF RUINED MY LIFE BY GOING TO COLLEGE.'"[17] The bubble or decline metatrend depends on students deciding to withdraw from postsecondary education because of such anxieties, possibly supported in that decision by authoritative voices.

Such decisions could culminate in, or depend upon, a cultural turn away from the late twentieth-century mandate of college for everyone. Glassdoor published a list of fifteen major companies willing to hire people without college degrees.[18] *Governing* magazine identified the American Northeast and Midwest as the areas most friendly to job seekers lacking postsecondary credentials.[19] The aircraft industry is expanding, and many of the new staff it will hire will not need a college degree.[20] Popular figures such as Mike Rowe campaign for young people to enter trades without the requirement of university experience. If these calls and policies grow into a significant driver of change on their own, that would represent a dire threat to many colleges and universities, while also marking a historical break in America's historical trend of rising educational expectations.

The crisis or bubble model goes on to describe a series of negative effects. Holding significant student debt may reduce chances of obtaining a mortgage, which can affect a person's finances while exerting downward pressure on the housing market.[21] Student debt has also started influencing young people's approaches to marriage.[22] Senior citizens are increasingly likely to be paying off student loans (either their own or those of family members) in retirement, placing stress on fixed incomes. The number of seniors holding student loan debt has grown over the past decade, and the amount owed increased by a factor of five.[23] The US Consumer Protection Agency published a report stating that student debt, especially from private financial institutions, was depressing the nation's overall economic growth.[24] Debt holders spending significant amounts on loan repayment have less to spend on other aspects of life, and the sheer size of student debt may have larger impacts still. The International Monetary Fund warned that student loan debt constitutes a financial risk for the broader American economy.[25] Financial securities built on student loans could become risks for the financial sector and those who depend on it.[26] This combination of negative effects suggests the possibility of public and private pressure on higher education to revise its fundamental strategies.

One such response is symbolic or even drastic cuts to tuition. Some colleges have experimented with significant tuition reductions, including private institutions and public ones, the latter at times spurred to do so by state governments.[27] One Catholic institution announced a tuition cut of more than 30 percent, and it did so using higher education bubble language:

> Private Catholic College Belmont Abbey today announced it is doing its part to burst the college tuition bubble by reducing its annual tuition cost to $18,500 beginning in fall 2013. This represents an almost $10,000 per year reduction in the College's published tuition price for incoming freshmen and transfer students.
>
> "Over the past 25 years, average college tuition and fees in the United States has increased more than 440 percent," said Belmont Abbey College President, Dr. William K. Thierfelder. "At more than four times the rate of inflation, that's not sustainable for the average American family so it's time to reverse the trend."[28]

Another response to this frightening metatrend is a campus strategy I have dubbed "the queen sacrifice." The term is from chess and refers to a player sacrificing their most powerful piece—the queen—in a desperate move to win the game. Applying the analogy to higher education, tenure-track faculty are the queen pieces on the campus boards, given their centrality to the teaching mission, governance roles, service work, and tenure protections. As such their removals should be unusual, yet such sacrifices have been rising over the past decade. Examples are, sadly, plentiful. The AAUP censured the College of Saint Rose for firing tenured professors.[29] An Indiana campus laid off or forced the retirement of seven tenured faculty.[30] Midway College laid off faculty and staff after failing to meet admissions targets.[31] Two regional public universities closed more than a dozen academic departments between them, laying off tenured and untenured faculty.[32] More than one-half of the Pennsylvania State System of Higher Education's public universities are considering cutting programs and faculty.[33] A small New Hampshire college is laying off

faculty and staff to relieve financial pressures stemming from declining enrollment.[34] The City College of San Francisco is planning cuts to its academic and support staff alike.[35] Northern Kentucky University announced layoffs of staff and faculty.[36] Kentucky's community college system also laid off staff and faculty.[37] Faculty and staff were cut from Plymouth State University.[38] The Universities of Wyoming and Illinois prepared to cut faculty and staff.[39] Some institutions offered senior faculty early retirement packages, possibly in rising numbers, including Oberlin College and West Virginia University.[40] Wartburg College announced plans to remove nearly 10 percent of its faculty.[41] Rider University threatened to end programs and established, long-term faculty positions, leading to its faculty making large contract concessions.[42] Goucher College eliminated a series of programs owing to low enrollment, including math, Russian studies, studio art, theater, religion, elementary education, and special education. Minors to be phased out include book studies, German, and Judaic studies.[43] Franklin Pierce cut six programs, five in the humanities.[44] Southern Methodist University announced upcoming layoffs and cuts to total $35 million, in order to address financial pressures.[45] Enough examples occur that we can identify the queen sacrifice as a rising trend on its own.

An alternative response to the higher education bubble or decline threat is to merge two or more institutions, in order to realize cost efficiencies and to build upon complementary strengths. Georgia's public higher education system continued a campus consolidation campaign by announcing the merger of two more institutions.[46] Two religious colleges—and rivals—agreed to merge for economic survival.[47] Wisconsin community colleges will be merged with that state's public universities in a move described as being driven by demographic changes.[48] Some state colleges are becoming universities through mergers or name changes in an attempt to lure international students with that institutional name.[49] The University System of Georgia recommended merging four campuses into two.[50] Pennsylvania's public university system is considering merging—or closing—

several campuses.[51] Several other northeastern and midwestern universities considered mergers.[52] Kennesaw State University and Southern Polytechnic State University merged.[53]

A related strategic option is the final one: closing an institution. One small college, the National Labor College, announced plans to close.[54] A small Nebraska university announced closure in 2017.[55] The Memphis College of Art will close, as will St. Gregory's University.[56] St. Catharine College in Kentucky decided to close.[57] Sweet Briar College is struggling to survive, after small class yields following its 2015 near-closure.[58] Dowling College threatened to close, as did the College of St. Catharine.[59] One 131-year-old historically black college announced bankruptcy.[60] The nation's oldest historically black university faces the possibility of ceasing operations.[61] A small Christian college in Florida decided to close.[62] Tennessee Temple University closed.[63] It is often difficult for a governing board or state government to close a college or university for reputational reasons, yet it is possible that that onus will decrease if more institutions close and normalize the occurrence.

Law schools offer a particular instance of the higher education decline theory, as they have suffered since the 2008 financial crash according to nearly every metric. The number of active professionals seeking law school professor positions dropped by 50 percent from 2008 to 2018.[64] Rumors of law schools closing or being merged have circulated steadily, if quietly, over the same time period. These graduate programs face choices similar to those available to universities and undergraduate colleges: merge, close, cut faculty, cut tuition, explore new curricular offerings.

One strategy for growing American college and university enrollment in all sectors has been aggressive recruitment of international students. This has buoyed student numbers for some institutions, while also helping achieve diversity goals (when global students are from racial or ethnic groups underrepresented in American academia) and financial needs (to the extent that those students are drawn from wealth). As noted in chapter 2, however, international

student numbers have declined in the wake of the Trump administration's immigration policies, the anti-immigrant rhetoric of Trump and his followers, and media coverage of gun violence in American schools. This challenge to international enrollment may persist as long as the Trump administration and gun violence continue to exert influence, and this period may extend beyond Trump's term in office.

A key part of the international student challenge in the medium or long term is the possibility that China will eventually send fewer students to the United States. China has energetically grown its higher education sector over the past generation, partly to rebuild from the damage it took during the Cultural Revolution, as well as to assist in growing that nation's economy during its famous post-Mao, post-Deng expansion. As of this writing, China may represent the largest higher education sector in the world, with more than 40 million students ("one in every five college students is in China," according to *China Daily*) and more than 2,600 campuses. Enrollment in Chinese higher education grew a staggering 500 percent since 2000.[65] It seems possible, even likely, that at some point over the next decade China will complete this construction period, once its universities are at capacity, its faculty publishing reaches American reputational levels, and its teaching becomes of sufficient quality. At that point China will no longer need to send so many students to the United States, and American campuses will lose a major enrollment source.

Geopolitics may also further reduce Chinese participation in American education. A trade war between the two nations is just beginning in 2019. It is conceivable that reducing the flow of Chinese students as well as collaborative research would be an economic option for Beijing to consider. American political and academic leaders may take public positions more critical of China, further chilling academic connections. We have already seen signs of this connection, as when two US House representatives accused China and Iran of "steal[ing] American technological secrets and scientific discoveries" through academic infiltration.[66]

Summing up, these trends and metatrends suggest a decline for American higher education. This future could take the form of an even smaller number of enrolled students, tighter institutional budgets, and a fewer campuses (through closures and mergers). American colleges and universities could also suffer a reputational decline, both domestically and abroad, as international competition continues to build. (See chap. 7 for a scenario based on these trend lines.)

Are there any combinations of trends that generate more appealing futures for American academia as a whole? Some analysts see colleges and universities continuing to grow, albeit along different lines and in new forms. The leading driver for such forecasts is the continuation of the college premium, the economic model holding that postsecondary degrees tend to give holders a better chance of gaining employment and a higher level of compensation than they would otherwise achieve. This model depends historical studies of large-scale developments in wages and benefits over a graduate's life span and admits a wide range of outcomes.[67] For example, a *Governing* report found that while certain regions are better than others for high school graduates seeking jobs, the overall tendency is for those with bachelor's degrees to fare better in the labor market. "According to Labor Department data published last week, 53 percent of adults with only a high school education or less were employed in July, compared to 72 percent for those with at least a bachelor's degree. Similar discrepancies exist for unemployment rates."[68]

Choice of major, degree-granting institution's reputation, and degree level can all make substantial differences in just how large a given person's college premium becomes.[69] Associate's degrees and certificates also yield a college premium, according to Columbia University research.[70] A corollary to the individual graduate's college premium is that American cities with universities tend to do better economically than those without.[71]

It is possible that the college premium may shrink as the labor economy changes, as if, for example, too many graduates seek jobs

after automation has outmoded the skills they fought so hard to obtain. The undergraduate degree may lose some of its power as so many people hold them or if cultural and political changes occur. Furthermore, the pace of contemporary technological change should caution us about simply applying historical data to the future. But if the premium maintains, the incentive to go to college should remain, even in the face of student loan anxieties.[72]

A second trend powering a more positive academic future for some is the rise of free tuition programs. The origin of this may be the 2016 Democratic presidential primary campaign, when Vermont senator Bernie Sanders called for a national free tuition program for public universities. This concept, initially ridiculed by some, was gradually accepted by a growing number of politicians. In 2017 New York governor Andrew Cuomo launched the Excelsior scholarship, a program that grants nearly complete tuition funding for that state's residents attending public universities, under a series of conditions. Notably, the governor announced the scholarship while standing with Sanders. The University of Illinois announced a free tuition program for students whose families earn less than $65,000 per year.[73] New York University announced a free tuition program for students enrolled in its medical school.[74] Disney announced a free tuition program, called Aspire, for its workers.[75] Such programs are expensive, but states and companies may increasingly come to see them as worthy investments in human capital and local economies. Further, it does not seem unreasonable to posit that reducing the cost of attendance may encourage more students to enroll in postsecondary education.

Another trend supporting a positive higher education forecast consists of a wave of curricular and financial additions and expansions. Many campuses have launched new programs or expanded existing ones in an effort to win more students and therefore sustain or grow revenue.[76] In terms of financial moves, some institutions have sought to realize greater value from their existing physical plant. For example, Eastern Michigan University outsourced campus parking to a third party in exchange for a multimillion-dollar payment.[77]

A fourth positive trend stems from the opinions of campus chief financial officers (CFOs) and business officers (CBOs). For nearly a decade after the 2008 financial crash many of these administrators saw deep challenges to their institutions' sustainability, yet following that period a majority expressed a new confidence in their situation, at least in the short and medium term. "Over all, 63 percent strongly agree or agree, while 14 percent strongly disagree or disagree, that they are confident their institution will be financially stable over the next five years. A year ago, 56 percent were confident." Private institution leaders especially hold this positive view. It may well be that a decade of financial stress led many colleges and universities to take steps (cuts, curricular realignments, changed student aid packages) that ultimately rebuilt their financial security.[78]

We may also experience rising enrollment not in undergraduate populations but in master's and PhD programs. The National Center for Education Statistics (NCES) recently estimated significant growth in graduate programs. "The total number of master's degrees . . . is projected to increase 30 percent between 2013–14 and 2025–26." Meanwhile, "the total number of doctor's degrees . . . is projected to increase 18 percent between 2013–14 and 2025–26."[79] If the NCES projects are borne out, it may be because of growing demand for graduate study in economies requiring specialized training. Advanced degrees may also help separate their holders from those with only undergraduate credentials, as the BA and BS have become more popular, thanks for the decades-long expansion of undergraduate education. For some employers, a BA or BS now functions in the way a high school diploma used to, as a quick certification of competency for adult employment.[80]

Importantly, the challenging trends hitting American higher education are, like William Gibson's future, unevenly distributed. Some states continue to grow their teenage population, like Arizona, California, and Texas. The University of California system anticipates drawing on a growing state population over the next two decades, according to a new report. "California's population is projected to

grow 22.5 percent, from 40 million to nearly 49 million, by 2040." While it is unclear what proportion of that population will consist of high school graduates, the total number certainly bodes well for local student recruitment in that state.[81]

It may well be that American higher education divides into two sectors, one with rising enrollment and healthy finances, while another dwindles, perhaps suffering from the bubble's aftermath. Each sector responds to the trends we have outlined in a divergent way, depending on their situation and strategy. For example, demographic forces are fiercest in the Midwest and Northeast but are friendlier to certain areas in the South, Southwest, and West. According to Nathan Grawe, a north-south corridor runs just west of the Mississippi River, from Minnesota to Texas, a region that "anticipates widespread, expansive growth" in the subsector of elite institutions.[82] If those demographic differences prove dispositive, this two-sector model could attain a clearly geographic cast. Some universities might succeed in matching curricula to student demand in a way that builds financial stability, while others fail to match effectively, perhaps through selecting the wrong fields, offering programs in glutted areas, or refusing to adjust course offerings at all and losing student interest as a result. Further, if this two-tier pattern emerges, it might become self-reinforcing as students move away from institutions perceived as declining.

* * *

At this point we pause our identification and analysis of individual and metatrends. We have discussed a large number of such change drivers, from demographics to economics, enrollment patterns to technologies. We have seen how each can help shape higher education's future, both individually and in combination with others.

Now we will focus closely on a set of these trends, using them to create scenarios. Each of the chapters that follow dives deeply into one or several trends, building up models of how higher education may transform if they play major roles in the years ahead.

Scenarios

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7 Peak Higher Education

"I KIND OF RUINED MY LIFE BY GOING TO COLLEGE"

Consumer Reports cover story

In this future, American higher education is in a state of decline. Academia reached a peak around 2012 and has slid downhill since. Undergraduate and graduate populations alike are smaller than they were during the thirty-year-long boom from 1982 to 2012. The total number of colleges and universities has likewise dropped. Within those remaining campuses, tenure-track faculty are a small minority, surrounded by part-time faculty and staff who struggle to maintain budgets that are far smaller than those of the early twenty-first century's glory days.

This scenario uses the peak model or metaphor, which may be familiar to readers from other contexts. It describes any process by which a metric rises for some time, reaches an uppermost number or limit (peak), then decreases. Graphically, the arc sketches a rise and fall, akin to a rounded hill or mountain peak. For example, some currently refer to "peak car" to describe an anticipated decline in a nation's entire automobile fleet and its usage. After a century of growth, wherein more Americans owned more cars decade after decade, the total number of vehicles may stop rising and begin to fall. That decline would occur as more people choose city and suburban life and its mass transit systems, along with the rapid adoption of ride-sharing

services such as Uber. Younger people in particular seem less interested in owning cars; should that disinterest follow them into adulthood and middle age, owning one or more automobiles will become even less popular. In addition, there is the possibility that the proliferation of autonomous cars will further reduce car ownership.

Readers may have come across the "peak water" idea, a model that illustrates an upper limit in water resource stocks and use: "Peak nonrenewable water is observable in groundwater systems where production rates substantially exceed natural recharge rates and where overpumping or contamination leads to a peak of production followed by a decline, similar to more traditional peak-oil curves."[1]

Peak higher education follows a similar pattern. As with cars or water usage, postsecondary education expanded in volume over decades until it hit a ceiling. After that point volume starts dwindling. Because American higher education's economic model depends on larger volumes (of students), that shrinkage may then accelerate. That is the basis of this scenario.

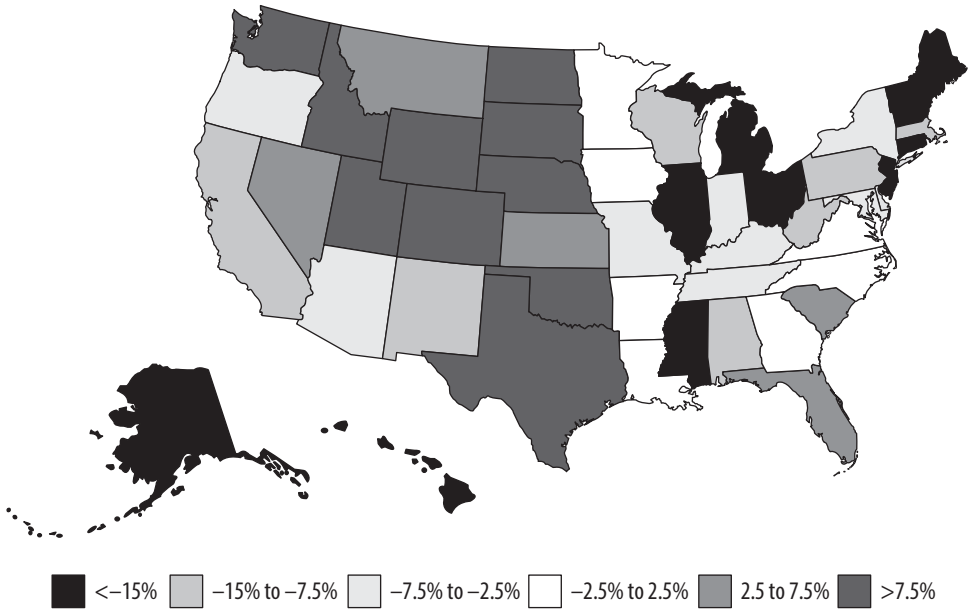
Several trends combined to create this future, starting with declining enrollment. From 2012–13 to 2018, the number of students taking classes in American colleges and university slipped 6.7 percent, from 19,105,651 down to 17,839,330.[2] Our scenario extends this decline a decade. It can allow for a mixture of continued decline with intermittent plateaus, still yielding a cumulative, if staggered, drop.

Macroeconomic and demographic trends further drive this scenario. After the 2008 financial crisis, unemployment declined steadily, reaching historically low levels considered the lowest possible by many economists.[3] In such a labor market more people can choose to work rather than take classes. This has had the greatest impact on community colleges, where enrollment is typically countercyclical to the labor market. Other adults dropped out of both academia and the labor market, motivated either by disability or the need to care for other family members. The latter is especially compelling in regions with aging populations, and when the social safety net for seniors is uneven or endangered. At the same time, some older Ameri-

cans chose retirement instead of the classroom, a development likely to accelerate as the massive baby boom generation begins to retire. Older people often don't feel comfortable returning to school, in part because of the (inaccurate) perception that college is for teenagers. Still others may combine part-time work with a rich digital existence and feel their lives complete without further education. Meanwhile, anxiety over student debt, the total amount of which crested $2 trillion in 2022, rendered postsecondary education a riskier proposition than it once appeared to be.

Demographic trends also play a key role in keeping enrollment down. As discussed in chapter 4, American fertility rates have declined commensurate with the rest of the developed world. While the total national population has grown, largely thanks to immigration, changing fertility patterns have led to a drop in the traditional-age student population, hitting the many colleges and universities that serve that very demographic. A strong hit comes in the late 2020s, according to Nathan Grawe, whose models show a steep drop-off in the teen population then, because of a sharp decline in conceptions in the immediate wake of the 2008 financial crisis, which virtually "eliminated" births. "Beginning in the mid-2020s many colleges will enter an extended period of shrinking recruitment pools . . . Total numbers of students are headed toward a cliff . . . both population and college-going students are expected to hold steady through the early 2020s before a brief and modest 5 percent increase precedes a precipitous reduction on 15 percent or more." Grawe's model shows this "precipitous reduction" striking especially hard in midwestern and northeastern states, the latter the most academia-rich area in the United States.[4]

Declining numbers of traditional-age students place enormous pressure on campuses largely dependent on tuition—which is almost all of them. Competition for a dwindling supply heats up, making interinstitutional collaboration even more difficult than it once was. Many campuses will risk raising their discount rates still further to attract in-demand students, placing further stress on institutional



Forecasted growth in high school graduates, 2012–32. *Source*: Nathan D. Grawe, *Demographics and the Demand for Higher Education* (Baltimore: Johns Hopkins University Press, 2018), drawn from WICHE data. Map taken from the supplemental materials, accessed July 25, 2018, https://people.carleton.edu/~ngrawe/HEDI.htm.

finances. This places greater financial stress on supporting students with the greatest need, and institutions may hear pragmatic arguments for gradually excluding them. In the words of William C. Dudley, president and chief executive officer of the Federal Reserve Bank of New York, "colleges that offered the largest number of low-income students pathways to upward mobility have become less accessible to them during the 2000s. As a result, higher education's contribution to increasing intergenerational mobility has diminished."[5]

At the level of family economics, some families have chosen to spend less on higher education, "downshifting" across institutional tiers to find the least financially draining fit. They might choose a campus close to home in order to avoid residence hall charges, anticipating the way some graduates return home as "boomerang

children." These strategies do not reduce enrollment in the aggregate but do reduce the amount of revenue colleges receive through tuition and fees.[6]

Political and perceptual trends contribute to bring this scenario about. A cultural politics celebrating skilled labor unaccompanied by university experience has begun to appear, championed by popular figures like Mike Rowe and the occasional Republican politician. A perception that certain skilled trades provided more rapid and debt-free paths to middle-class lives offered was attractive to some would-be students, especially those with family traditions of skilled labor as well as those who have enjoyed time spent in makerspaces. A related cultural current urges people, especially young people, to turn away from the digital world and return to the better realm of printed media and analog labor. State governments retain their way of thinking that higher education is a private, not public, good, and accordingly either refrain from launching free tuition programs or cut back on current ones. In this scenario we posit that such cultural politics gains some traction.

These external factors combine to exert enormous pressures on colleges and universities. As the student pipeline narrows, the "amenities arms race" continues and intensifies. This consists of improved physical plants (residence halls, cafeterias, wellness centers, broadband networks, not to mention climbing walls and lazy rivers) along with student life programs and additional staff support. While one can overstate the costs of these, especially for commuter campuses, and recognize that "less than 20% of America's college students actually live and eat on campus," they nonetheless represent additional budgeting during a time when many institutions face budget pressures.[7]

The drive to expand postsecondary education to more people has meant a larger first-generation student population. Generally speaking that group needs additional campus support, such as remedial or supplemental academics, academic advising, career counseling, and financial assistance. A growing number of students bring with them learning disabilities, which also necessitate further campus support.

Taking these trends together, in the decades after 2012 we can see American colleges and universities instructing fewer yet more costly students than in the past. Absent a new wave of philanthropic support, a renaissance of state funding, or a sudden economic boom that freshens endowment and tax yields, serving the peak higher education student body requires higher tuition and fees. These price increases, in turn, further heighten general anxiety about college costs, which might disincentivize more people from considering postsecondary education, and so a vicious cycle builds, driving higher education further down the slope from its historical peak.

An additional pressure comes from a decline in the number of international students attending American colleges and universities. While that number grew steadily during the post–Cold War era, it turned down in the wake of recent developments, as noted in chapter 3. The Trump administration's anti-immigrant rhetoric and policies gave many would-be students worldwide the sense that the United States was no longer a welcoming place for postsecondary study. Recent school shootings added a layer of physical danger. The former development could well continue, should Donald Trump win a second term. Moreover, Trump's 2016 electoral victory revealed that America's long-standing animus toward immigrants had persisted; this, too, could continue even in the face of future pro-immigrant administrations, further challenging America's international academic reputation. Similarly, American attitudes toward gun violence and ownership do not at present suggest a swift resolution in favor of declining violence, and could therefore keep a vision of a dangerous nation before the eyes of would-be students around the world. Therefore international and domestic student enrollment follows a downward curve throughout the 2020s.

We could see a total postsecondary enrollment—combined undergraduate and graduate student populations—that drops from 17,839,330 in 2018 to 16,768,970 in 2024 and 15,762,832 in 2030. As most American institutions depend on tuition and fees for their sustainability, such decline exacts casualties. The number of colleges

and universities shrinks slightly from 4,627 in 2014–15 to 4,164, owing to closures and mergers.[8]

Some of those campuses have reduced their curricula through closing or cutting back on certain programs, especially those enrolling fewer students than others, and often in the humanities. There are new programs, usually aimed at attracting enrollees in fields perceived as exciting, associated with growing jobs, or both. The peak higher education campus is more oriented toward STEM disciplines, more professional, and less humanities-rich than the institutions of a generation past. This process of curricular revision has involved the reduction of tenure-track and tenured faculty, a strategy I previously referred to as the queen sacrifice (see chap. 6). The proportion of faculty who lack tenure has increased from the 75.5 percent observed in 2018 to 87 percent by 2026. The proportion that are part time (as opposed to full time yet off the tenure track) has grown from roughly 50 percent in 2018 to 75 percent in this imagined future.[9]

That is total enrollment, in both face-to-face and online classes. Here we presume that the former have steeply declined while the latter have not made up the difference. Although online learning has a variety of advantages, it still possesses a reputation for lower quality. This scenario holds that online learning never breaks free of that problem and does not follow a Christensen-style disruption pattern. Instead, both digital and bricks-and-mortar systems contract.[10]

To be clear, students still take classes taught by faculty and supported by staff of various kinds. The peak higher education scenario doesn't see colleges and universities as extinct, but as having been reduced by an important degree. This isn't quite the experience of previous shrinkages, as with business and entire industries being massively outmoded by technological innovations. The scenario does not posit the sector being outflanked by a newcomer, like the specter of massive open online courses (MOOCs) briefly was. It is closer, metaphorically, to the "peak car" idea of a massive American collective enterprise that finds itself reduced in scope, its supply forced to cut back in order to meet a smaller demand.

Different sectors within American higher education may respond in separate ways to the post-peak world. Community colleges have the historical option of contracting faculty numbers (remember that most are adjuncts) in programs that enroll relatively few students. At the same time they can rapidly pivot to offering new classes and programs for emerging needs, responding to perceived community demand. Community colleges may soak up students who would otherwise enter other postsecondary sectors if anxiety about cost and debt continues to soar. Alternatively, community colleges could dwindle, especially if they fail to capture students exiting the for-profit sector.

For-profit institutions will have similar possible responses (reducing faculty and programs, growing others), given their similar reliance on part-time faculty and focus on the profit motive. This sector could shrink further still, however, should the federal government decide to cut back on its financial support as the student body becomes smaller, or continue Obama-era regulatory responses, or both. For-profits also face the additional challenge of confronting a severe reputational crisis as they seek to attract new students through new programs.

In contrast, the liberal arts world could split, with the top-ranked campuses relying on their reputation and endowments to win sufficient numbers of students to continue, while their lower-ranked peers face options similar to those presented to community colleges: reworking curriculum and faculty composition. The second group may transform into something more like a preprofessional institution and less like the traditional liberal arts campus.

Historically black colleges and universities (HBCUs) may also shrink in number of campuses as well as total student enrollment. Public institutions could compete energetically for black students by offering additional tuition discounts and student services. Community colleges could follow a similar path. Conversely, if interracial tension persists, black students may continue to see HBCUs as excellent sites for learning within black culture and with especially caring environments.

For research and state universities, much depends on their reputation. As with elite liberal arts colleges, the most highly ranked should be able to ride out the post-peak storm. In contrast the middle- and lower-ranked colleges and universities may struggle with winning state funds, as state legislators argue that schools teaching smaller numbers of students should receive less funding. There may also be a problem in hiring sufficient numbers of researchers, as decades of adjunctification turned a large group of qualified people away from the research route. As one adjunct observed, scholarship may shrink: "For adjuncts scrambling between multiple short-term, poorly paid teaching jobs, producing scholarship is a luxury they cannot afford. 'We have lost an entire generation of scholarship because of this,' [said] Debra Leigh Scott, an adjunct activist and documentary filmmaker . . . 'Adjunct contracts not only drive professors into poverty, it makes it next to impossible for them to do the kind of scholarship they have trained an average of ten years to do.'"[11]

The lower- and middle-ranked colleges and universities may face additional problems if they are seen to be contracting rather than innovating. Their reputations might suffer, making it even more difficult to attract students and win support from alumni. They could well enter what Bloomberg News columnist Michael McDonald refers to as a "death spiral," especially if they are located in unattractive or demographically challenged areas.[12]

Short of reductions in force, all these institutions may choose other types of cuts along familiar post-2008 lines. Administrations may reduce professional development funds, request or insist on furloughs, pause searches for open positions, reduce benefits (health care and retirement in particular), request or mandate early retirements, alter or remove tenure from those who have it, and outsource many campus functions. At the same time, economics will incline campus leaders to solicit support from the wealthiest in the form of grants, political support (especially for public colleges and universities), and gifts (from alumni). Similarly, each institution will have to consider just how much more energetically they should pursue students from

the wealthiest families. As a result, members of the economic 1 to 5 percent may seek a greater governance role in higher education, from influencing laws to serving as activist board members to greater restrictions on donations.

One macro-effect may occur across the nation, as American academia declines. The population of citizens and residents could become less well informed by academic learning, given less exposure to post-secondary education. This may well have profound impacts for the popular reception of science as well as the citizenry's ability to engage with a democratic government.

How long might American higher education slide down the peak's wrong side? Much depends on how many of its constituent trends play out. Over time, enough might change to again build up student enrollment. International student numbers could rise if America sheds its Trump aura. The wave of people turning to trades may recede if those jobs fall to automation. A sea change in American culture and politics could bring back the notion of public higher education being a public good. Embarrassment at falling behind in international measures of learning could trigger a productive backlash. Or enough American campuses could sustain innovation in ways that elicit a new generation of students of all ages and from around the world. We might expect peak higher education to last a decade or two, even a generation, unless we can collectively turn it around.

In the meantime, we should expect external innovation to occur. Since the 2008 financial crash and the peak of higher education, we have seen new efforts appear: code academies, MOOCs, and projects like Minerva. In the peak higher education world, other efforts could manifest around the sector's shrinking border. Analogically, we may learn from the environmental crisis known as "peak sand." The amount of available sand worldwide has turned downward, just as needs for it, including industrial demand, have risen. As a result, creative entrepreneurship has sought to find, create, or redistribute sand, including in illegal ways.[13] Applied to post-peak higher education, we should expect a similar zone of development, both ethical and otherwise.

8 Health Care Nation

In this future scenario, health care becomes the largest sector of the American economy. It employs more people and generates a bigger slice of the gross domestic product than any other service or industry and is still growing. Medical services play a larger role in people's lives. Social spaces have changed as a result, with towns and cities hosting more clinics, hospitals, drugstores, medical supply stores, and laboratories than in the past. The largest medical buildings stand out in urban areas the way that churches used to mark towns. Higher education is powerfully altered as a result.

Which trends drive this scenario? To begin with, the health care sector is already large as of this writing, encompassing a wide range of services and domains. Professional staff include nurses, surgeons, hospital administrators, radiologists, anesthesiologists, ethicists, physicians' assistants, pharmacists, home health care aids, lab techs, first responders, and researchers, not to mention the lawyers, IT staff, custodians, office managers, librarians, security officers, laundry workers, housekeepers, and more who keep the system running. The most recent data assign the total as eighteen million workers in 2018, or around 14 percent of the entire American labor force. According to one observer, health care became the nation's leading employer as of 2018, employing more workers than the entire retail sector and also all of manufacturing.[1]

An economic sector employing that many people requires appropriate levels of funding, especially when we consider how heavily the

industry relies on advanced technology and how frequently it engages with the courts. In 2010 the total cost stood at $2.6 trillion and continued to grow. By 2011 one pair of researchers found that "the United States spent $2.7 trillion on health care, more than double what was spent in 2000." By 2016 that figure grew to $3.4 trillion, according to one researcher, or 17.8 percent of the economy that year, according to health care reporter Tami Luhby. By 2017 the medical sector cost "nearly $3.5 trillion," according to the US Centers for Medicare and Medicaid Services (CMS).[2] Those costs are rising. A rate of 5.3 percent for next year, above last year's 4.6 percent, is substantially beyond a general inflation rate of 2.1 percent. That last cited research group foresees continued cost growth: "CMS projected that healthcare spending will on average rise 5.5 percent annually from 2017 to 2026 and will comprise 19.7 percent of the U.S. economy in 2026, up from 17.9 percent in 2016. By 2026, health spending is projected to reach $5.7 trillion."

The reasons for these increases are widely debated, especially in the global context, wherein Americans pay more for health care than people in comparable nations. They include especially rapid cost rises for pharmaceuticals, the unusually large research and development segment of American health care, the long-term costs suffered by those who cannot afford preventative or short-term treatments, the scale of payment bureaucracies, insurance costs against malpractice lawsuits, and the lower efficiency that a non-national health care system possesses.

If we extrapolate without allowing for significant variations, we can easily envision a time when health care dominates the landscape. Such an extrapolation is not unreasonable, since health care is more resistant to economic fluctuations than many other sectors, as people value medical treatment highly and can hardly avoid getting ill or injured during a recession. Furthermore, health care has experienced continual job growth over the twenty-first century's first decade, growing more than 22 percent over that period, which included the worst economic crisis to afflict the nation since the 1930s.[3]

Changing demographics are likely to support such growth, if not accelerate it. The American population is aging, as discussed in chapter 3. As people age, they statistically consume more health care,[4] so funding should increase accordingly. As CMS notes, "Higher spending in Medicare and Medicaid, the government health insurance program for the poor and disabled, are also expected to contribute significantly to rising health spending as the population ages and relies more heavily on healthcare services."

That aging population also benefits from the invention of new treatments and the expansion of formerly rare ones. The remarkable and steady pace of medical invention, from drugs to implants, requires financial support, which is ultimately borne by consumers through premium payments, taxes, out-of-pocket expenses, and borrowing. A larger senior population has driven the expansion of memory care facilities as well as multiple forms of assisted and independent living. Gerontology is and will increasingly be in high demand, yet the specialty is dangerously understaffed nationwide, as Atul Gawande and others have observed, which should increase compensation for those specialists.[5]

The preceding paragraphs describes the present. We can extrapolate into the future by assuming that health care innovation proceeds at the pace of recent history, without shocking breakthroughs on the order of the polio vaccine or the discovery of DNA. We should therefore expect a continued stream of new treatments and technologies, both generated from within the medical world as well as imported from other domains. More artificial intelligence will be deployed across the health universe, from diagnosis (both professional and self-conducted) to medical research. More data can be analyzed by human and AI alike. Telemedicine will increase, and the use of robotics will grow. Drones could deliver drugs or other supplies to both patients outside of clinical situations and in emergency situations. New physical materials can be applied throughout the health care world, from implants and bandages to wheelchairs and surgeries. Again, none of these are earth-shattering

surprises. They all add to health care's costs and can expand its overall footprint.

Innovation may reduce some costs by reducing time spent in care or more rapidly diagnosing ailments, but the total cost seems likely to grow. First, health care is a classic instance of Baumol's cost disease, whereby a service suffers critically when the speed of its performance increases. Readers will have no difficulty imagining the horrors of a surgery conducted too quickly, or the humanitarian suffering induced by seeing patients in insufficient time or drug treatments ended before their course.[6] Moreover, America's unusual medical financial structure, consisting of large insurance companies issuing coverage that is paid primarily by employers with a mixture of state and federal governmental financing (unevenly constructed from state to state), with the generally unspoken practice of uninsured people using emergency rooms for care, suggests rising complexity to come. Total cost savings are unlikely to emerge from this system. The Affordable Care Act (2010) helped keep costs from accelerating even more rapidly, but costs continue to grow, albeit at a less drastic pace than they otherwise would have.

We can now imagine such a health care behemoth dominating American society and its economy within a decade. Melissa D. Aldridge and Amy S. Kelley forecast "that, by 2040, 1 of every 3 dollars spent in the United States will be spent on health care."[7] In that world we set this scenario.

Higher education necessarily changes in the Health Care Nation scenario. For one, postsecondary curricula adapt in order to support the full range of allied health. Colleges and universities offer more academic programs devoted to medicine. Degrees in fields like nursing, surgery, radiology, gerontology, and hospital administration have expanded or been introduced to new institutions. Formerly undergraduate-only campuses now add degrees in nursing and physicians' assistants to their previously established premed degrees. New topical courses have proliferated across the curriculum, from medical AI ethics to health care history, computer science for medicine to

3D bioinformatics modeling, sociology of old age to the literature of long-term care. More departments reach out to this growing need; we will speak of allied health education across the curriculum.

The number and scale of medical schools have grown. Relationships between campuses and the health care sector have also expanded. Some colleges and universities partner with local clinics and hospitals to share space, with campuses offering excellent classroom environments while medial institutions offer real-world learning. Partnerships for internships also rise. Academic libraries reach out to clinics in a strategy of information entrepreneurship. Instructors bring in medical practitioners as classroom speakers. Student- and faculty-driven start-ups seek to meet health care needs, at times supported by city or state governments.

Different educational sectors respond to this health care–driven world depending on their historical roles and present strategy. Research-1, or R1, universities continue to conduct experiments and to publish cutting-edge research. Some if not many also operate medical facilities on-site: clinics, hospitals, labs. Interdisciplinary work will multiply, as fields like robotics, finance, and literary criticism seek various connections with the nation's leading force. Pedagogical experiments should ramify as medical and health care–adjacent fields explore new ways of making the field accessible to a growing population: active learning, live video, mixed reality, telepresence robotics, and more.

Community colleges already train students for a variety of health sector positions, and we should expect that to simply expand nationwide. As with R1s, two-year institutions will connect other disciplines to allied health, from cybersecurity to 3D printing. Partnerships with businesses, nonprofits, government, and other postsecondary schools covering a range of options (internships, sponsorships, cross-training, space sharing, professional development) should also increase as the full range of health care expands. Community colleges will also pursue innovations, including offering stackable degrees upon which students can add further health care learning.[8]

The liberal arts world may approach Health Care Nation with some hesitation or internal conflict, as many of those campuses seek to strike a balance between career preparation and non-market-based intellectual inquiry. Some will decide not to engage the enormous medical sector any more than they did in the early twenty-first century, while others will energetically modify their curricular, research, and outreach strategies. Many may offer interdisciplinary programs in and around the medical world, bringing to bear diverse intellectual approaches from history, ethics, and leadership, while attempting to avoid the appearance of preprofessional degrees. Others may partner with regional state universities to provide a career pathway for interested and well-prepared students.

Those state universities are likely to try embracing all of these purposes to different degrees, depending on their individual geographical and strategic situations. For example, those located among aging demographics (the American Midwest, Northeast, and Appalachia in particular) should be more likely to emphasize elder care fields. Graduate and certificate programs may appeal to students and administrators alike. State officials may take an interest in combining "meds and eds," possibly offering rare financial support for programs in politically important domains.

Overall, Health Care Nation sees many more people across higher education involved in medical and related fields than ever before. Larger numbers of faculty will be required. Support staff will also grow, both in direct ways (lab managers, medical librarians) and indirect ways (general IT capacity to support greater technology infrastructure). More students enroll in more medically related classes than ever. It seems likely that most of those students will be women, given the historical prevalence of female students in many health care and life science fields, along with the plurality of women in the student body overall. This could contribute to an overall gendering of higher education as female, which challenges many forms of institutionalized and personal sexism. The Trump era suggests we should expect multiple instances of backlash.

The sociology of Health Care Nation's learners may change in other ways from what we see today. Adult learners may constitute a large proportion of the student body, as some professionals already employed in allied health will seek new work skills as their fields evolve. Adults employed elsewhere, or unemployed, may seek degrees in order to join a rapidly growing industry. Similarly, more traditional-age students should take programs in allied health care's full curricular range, given the job opportunities. Behind that demographic we can envision secondary school students participating in more classes aimed at preparing them for collegiate health care study than there are in 2018. We can expect high schools to offer more and new classes in such fields; perhaps "pre-pre-med" will emerge as an awkward yet descriptive term for that emerging curriculum. Given the prominence of medicine in American life within this scenario, some teens will view well-known medical figures as aspirational heroes. A growing number of those teenagers may already be familiar with eldercare practices, given demographic and housing trends.

Other academic sectors beyond allied health are affected. Development offices devote more of their resources to reaching out to the health care sector, both because more of their graduates will work in that field and because of the higher incomes often found there. Libraries may have to devote more staff, collection, and instructional support to medical classes and research. Campus computing serves a larger and more challenging medical IT space, including many physical devices (the full range of life sciences and advanced computing hardware, simulated patients, and treatment spaces) as well as software (transcription tools, electronic medical records, and the aforementioned life sciences suite). Health care instruction has historically embraced new technologies, which means campus IT will have to support higher usage levels of the technologies outlined in chapter 4: virtual reality and modified reality for visualization, robotics and software for simulation, and the combination of big data, data analytics, and AI. A growing percentage of IT resources will flow to health care class and research needs; per-

haps micropolitical friction will arise between those fields and the rest.

We should expect other educational innovations. Multi-institutional or system-based programs enable learners to build degrees composed of classes from across a region, as with the ten colleges within the Maricopa County Community College System.[9] High demand unmet by local capacity could drive such efforts. Such new systems would lead registrars to spend an increasing amount of time dealing with transferring medical class credits. New classes and degrees will be developed to meet emerging health care needs. Cultural and political conflicts that ripple across health care in its social context will appear on campuses, facilitated by social media and mobile devices: debates over end-of-life care, questions of privacy and technology, the acceptability of certain treatments, and, of course, birth control. Faculty may have the opportunity to engage as public intellectuals.

9 Open Education Triumphant

In this scenario the open paradigm has succeeded in shaping the way we use most digital information. The transformation has occurred not just in higher education but also across other segments of civilization: journalism, information technology, entertainment, and business. Individual and group behaviors have been altered as well.

We understand "open" to describe three different types of information. First is open education resources (OER), materials for learning that one may access easily, for free or for low cost, and with the possibility of reusing and remixing them. Second is open access in scholarly publication, the practice of publishing scholarly content (articles and monographs, along with data sets and associated materials) that is accessible to any interested person, available for free or for much less cost than is presently charged for these materials (see also chap. 5). Third is open source software, computer applications whose underlying digital structure is accessible to any would-be observer or user.

These different forms of openness succeeded by 2030 partly by virtue of incremental change and persistence. Open source software took off in the 1990s, scoring major successes with some projects, standards, and businesses, then became simply part of the software landscape. Some governments offered public funding, licensing, and grant structure support and encouragement. OER and open scholarship grew steadily during the early twenty-first century, accreting open content bit by bit and winning over more adherents every quarter.

In 2018 the National Association of College Stores (NACS) found that "32 percent of students reported using free course materials, compared with 25 percent last year and 19 percent in 2016."[1]

Growth by quantity played a key role; quality improvements were also crucial in the triumph of open access. To an extent this was an effect of reputation and cultural cachet, rather than most measures of quality, as proprietary publishers continued to release elaborately produced books and multimedia artifacts while a good number of faculty remained committed to familiar brands. Open projects gradually competed with this challenge through improvements in quality as well as by growing the reputation of key projects, the Public Library of Science (PLOS) becoming a signal leader in this endeavor. Sponsorship from multiple government agencies also helped build open's reputation. For OER, increasing concerns about income inequality helped convince faculty to turn to open access, as did rising anxiety about the poverty of students; Sara Goldrick-Rab's groundbreaking public scholarly work proved decisive on this point.[2]

Activists played a major role in criticizing proprietary content and encouraging academics and others to participate in the open world. Libraries were crucial in the transition to open, as they were early adopters of scholarly material repositories, encouraged faculty to adopt open access publishing mandates, and negotiated with publishers. Some instructors took the lead in pointing students toward open materials. According to NACS, "just under 60 percent said their professors had provided them with the free materials."[3] Organizations and nonprofits like Creative Commons sought to persuade academics and the broader world of open's value. Meanwhile, open quality improved on other measures through several processes: peer review, marketplace competition, and continuous development. Successful commons-based peer production also played a role, with contributors successfully collaborating in distributed yet structured ecosystems.[4] OER co-creators gradually applied instructional design and human–computer interaction principles to their work. Discoverability improved through better search tools and growing use of directories.

The transition proceeded unevenly by geography and institution. Certain governments led the way in pushing for open access through policies, grants, and their own practices, while others took no steps or actively resisted. Some nations, universities, and activists in the developing world advocated for open as a way to win equitable access to materials largely enjoyed by developed countries, as well as to create channels for their scholars to contribute more fully to the overall human research enterprise. The OA2020 initiative drove Europeans more rapidly toward the open flip, while the Association of College and Research Libraries championed the digital literacies that librarians deemed necessary for a more open information world. Online classes and certification helped raise awareness of and spread knowledge about the practical skills and processes needed to flip a sector, business, or industry to open.[5]

At some point in the 2020s each of these movements flipped its domain from majority closed to majority open, depending on which metric and which study one used. The majority of textbooks used by students were OER by the 2021–22 academic year. The majority of scholarly articles were available through open access in 2023. Most monographs were open by 2025, and by most measures so was the bulk of software in 2028.

Along the way each form of open access faced opposition of all kinds, from the thoughtful to the self-interested, from the ill-informed to the scaremongers. Battles and arguments took place in the mass media, social media, courtrooms, private offices, legislatures, and classrooms. Many open efforts failed, including software projects, content archives, and businesses based on open. Yet the net outcome year after year was a tendency for more open content to appear until the flip to a majority of material being open was achieved. Since then no retrograde movement occurred.

The resulting world is somewhat different from that of 2018. Some business sectors have experienced major contractions, including movies, software, music, book publishing, and scholarly publishing. Others have transformed radically, creating new business models or

migrating to new markets. New firms have appeared to support open creation, discovery, and use, along with nonprofits fulfilling some of these functions. Overall, more information and creative content exist than before and increasingly flow across all kinds of boundaries.

There are more conversations worldwide as networks carry communications over those boundaries. Some filter bubbles pop as companies that restricted users and their access to content fade or transform.[6] There is more creativity as people respond as they often have to accessible, reusable content: responding to content with commentary, remixing it into new content, building new structures to navigate the ever-growing amount of stuff, and creating new information and stories through inspiration, parody, and critique.

This plethora of content has made data analytics more important, since good use of data allows people to better understand the many paths through the open ecosystem. For some people the value of content has collapsed, while the ability to use data to work with content has become valuable, leading to new businesses and practices. Software, largely open source, helps people in this future work with these materials. The complexity of such analytics helped drive the development of intelligent software to better apprehend them. Artificial intelligence (AI) tools give insights into the reliability of materials, how they develop over time, how they relate to other content streams, and more.

In this future people often speak of an "open mind-set" or "open practice." These terms describe an attitude of being inclined toward publishing and sharing what one creates, be it a comment, a video, or a data set. Holders of this mind-set are also likely to turn to the open Internet for content to access, remix, and be inspired by. Coders prefer to start with open code they can modify.

Within this open world higher education has also changed. Academia tends to assess some of the developments in a positive light. The price of information has dropped, so students are pleased to pay less for course materials, while libraries and researchers delight in spending less for scholarly journals, articles, and monographs. Con-

sumers around the world enjoy more access to scholarly content, now that the majority of it has escaped from paywalls. Autodictats and professional researchers who previously lacked access to both learning and scholarly materials can now progress further and more rapidly in their work, which leads to improved cultural and economic outcomes for their regions.

Faculty members and librarians display more creativity in using this expanded amount of content, wrangling or making more multimedia materials of their own and generating new practices for research and learning. Librarians and IT staff similarly respond productively to this surge in digital information. Libraries publish new finding aids, teach new classes, and explore the history of information to look for inspiration in how previous ages responded to upsurges in content.

Pedagogies changed as a result of open's triumph. More students experienced more content, as class materials and scholarly research became more affordable. Classes took better advantage of remixing possibilities to edit and produce new versions of OER. Students increasingly played a role in co-creating content, both textbook materials and scholarly research. Student-authored materials became more popular. A shift toward student-centered learning and constructivist pedagogies occurred, driven by these changes in content availability. Instructors increasingly taught "in the open," sharing more of their practice to the open Web, boosting professional development possibilities. Students can learn in the company of more learners, both in terms of absolute numbers and diversity, once fellow students can be connected with from far beyond a given classroom's walls.

Meanwhile, many surviving companies that serve academia have shifted their operations to respond to open's triumph. Some scholarly publishers are essentially data analytics specialists, providing value by helping researchers see links between documents, tracing patterns of discovery, and generating insights about articles and monographs through data mining and AI. Textbook publishers offer instructors ways of better understanding student progress, while promising

students improved learning results. Further, some companies position themselves as open enablers, guides to the wide-open world of seemingly chaotic content, assistants to campuses trying to integrate these materials into systems and curricula.

Nonprofits also work in this intermediary space. Established associations like the Creative Commons, the OER Commons, and the Directory of Open Access Journals (DOAJ) provide resources to help people navigate and contribute to the sprawling open world. Others, like the Digital Public Library of America, publish links and connections to open content without hosting them directly. Others offer the kinds of support services companies provide, but without the profit motive. Academic nonprofits and associations that existed before the open access era help their members as well.

Other aspects of open's triumph appear problematic or outright harmful to contemporary academic observers. The collapse of certain businesses has had negative humanitarian and economic consequences. Some technologies have failed to develop good open source software solutions, so their user experience degrades. With the collapse of some barriers, including walled gardens, comes an increase in the circulation of malware; the reduction of some filters means an expansion of abuse. Privacy, already challenged by state and business surveillance, becomes even more frail in this situation. Older students, having been socialized by classroom experiences strongly bounded by multiple enclosures (a classroom's physical walls, the restriction of copyrighted content online to single instances of a class, policies driven by federal privacy laws like the Family Educational Rights and Privacy Act and the Health Insurance Portability and Accountability Act), find the open environment disturbing at times, and possibly uncomfortable for their learning practices. These challenges can cost organizations and individuals money, increasing some operational costs. Additionally, one flipside to creativity and content growth is that creative ownership becomes more difficult to ascertain, especially as remixing becomes easier to accomplish and identity more easily spoofed.

Campuses experience further changes. IT offices see support and training needs shift away from products maintained by established vendors and toward community-sourced projects. Campus IT also struggles with the rising tide of malware and threats to privacy. Supporting some open materials, especially software, is a challenge when it is not clearly designed to integrate with a campus enterprise environment. Librarians see their roles become more prominent as teaching students (along with faculty and staff) to better navigate the increasingly chaotic open world requires further instruction in information and digital literacy. For some institutions, digital literacy becomes central to their curriculum.

Teaching and learning occur more often in the open, as course materials are usually available to the world, as is student work. Students, especially those belonging to marginal or threatened populations, can therefore encounter abuse from beyond their class in the course of their learning. Other learners can follow student progress through lessons, giving them insight into learning, while making plagiarism easier and test security more difficult. Instructors can now access vast amounts of teaching materials for their own use. Researchers can share data and papers more readily, leading to greater collaboration while accelerating the pace of scholarly publication.

The learning management system has mutated. Some LMSs consist of small modules that secure some class information (grades, registration details) connected to other programs and functions that work across the open Web (readings, telepresence labs, discussions). Some campuses have minimized their LMS deployment in favor of supporting learnings in creating their own personal learning environments (PLEs), assembled from the open Web and structured to match a learner's progress through a curriculum. These PLEs are sometimes centered on documents that demonstrate learning, such as blockchain-published microcredential stacks or media-rich e-portfolios.

Institutional variations in the age of open's triumph are widespread. Some research-focused universities will struggle to switch faculty over from closed inquiry to open practices. Professors belonging to

subscription-based scholarly societies and those who author textbooks are likely to be especially resistant. But the budgetary advantages of open access for libraries are attractive, as is the prospect of researchers reaching a larger, more global audience for their work.

More teaching-oriented campuses, such as community and liberal arts colleges, will create new mechanisms and practices for protecting their students while showcasing faculty teaching. Hands-on work with open content and open source software will be configured differently in different institutions, depending in part on their attitude toward production (as opposed to studies). The liberal education model of close student–faculty relationships and undergraduate research should lead some instructors to use more open materials, since they afford students the chance to co-create, modify, and remix academic content. As a result we should expect the appearance of OER featuring students as coauthors, both of the initial work and of subsequent iterations.

For community colleges the cost points involved in using both OER and open access scholarship are attractive given the economic precarity of much of their student body. At the same time, and for this same reason, community college systems are likely to produce open educational content, especially for courses in high demand—algebra, college writing, introductory biology. Community college libraries may collaborate with local, state, or federal governments to win resources for further OER creation and re-use.

State colleges and universities should see a similar appeal in OER, given that their public mission requires, to some degree, serving all residents, including those for whom one expensive textbook could mean the end of their academic progress. Statewide systems may follow the example of the State University of New York's open initiative in identifying and meeting system-wide needs that OER can address. We could see states proudly hosting academic content generated by students, faculty, and staff from multiple public institutions. Similarly, states could host data analytics applications that run across open content used by local colleges and universities, vetted by lawyers

and policymakers. The politics of this endeavor can become complex and challenging. For example, state governments will reward or punish open-embracing public universities depending on the political stances of the legislature, governor, students, staff, or faculty.

The rising generation of younger students has a somewhat different worldview than that of pre-open-world elders. They are more attuned to a chaotic digital environment. They have grown up expecting most content to be free and easily accessed, and fine proprietary databases, digital walled gardens, and paywalls to be strange, stodgy, and offensive. At the same time some find themselves attracted to closed and proprietary content and architecture for their combination of retro flair and marginal status. This generation's sense of digital identity is playful, based on multiple identities worn as masks in different situations. Some of the content giants of the 2010s, so vital to their elders, are as distant in their minds as the historical titans of Greece and Rome.

10 Renaissance

The renaissance scenario is unusual in that it offers a retrospective future. It is based on a series of trends reshaping higher education over a generation, but their importance is only clear afterward.

We must imagine the year 2030, when a group of scholars are engaged in assessing recent history. Their framework is the previous generation, which they are considering renaming "the post-Web era." In their discussion they touch on a variety of events and developments in that period, from the War on Terror to the second presidential term of Alexandria Ocasio-Cortez, the rise of the mobile phone and the first great wave of climate disasters to the global fertility conflicts. We can imagine them gathered in a committee room where the old and new combine: tall bookshelves and wide display screens, wooden chairs bumping against 3D printed tables.

During their discussion one scholar suddenly offers a new idea. "I think we have assessed the entire period incorrectly," she begins. "This past generation is not an intermediary phase, nor does it constitute the first decades of the Fifth Industrial Revolution. Instead, we can best understand it by naming it a new Renaissance."

Her colleagues silently ask their AIs to summon documents in multiple media on previous renaissances, including the Harlem, the Elizabethan, and the Italian. As these files and data flows arrange themselves in different devices, including projections upon one professor's retina and whispers into another's ear, one researcher protests. "Surely you are overstating the case. How can such a positive term cover such

a multitude of crimes and horrors? And what historically important cultural developments can you identify as being worth of so extraordinary a term as 'Renaissance'?" Murmurs come from different devices, the voices of other scholars around the world, now joining the face-to-face conversation digitally.

Our first professor nods. "First, you are misunderstanding the nature of a renaissance period. Yes, it sees great steps forward, but not without great tragedies. The Italian Renaissance took place with plagues, civil wars, and great cruelty, including launching global exploration missions that then gave rise to terrible colonial enterprises. The Harlem rebirth occurred amid poverty and massive racism. The period we're looking at today is actually not so terrible in comparison. No matter what you make of 9/11, Trump, and the Ebola scourge, they pale in comparison to the great wars of religion and to the depopulation of the Americas.

"At the same time we have seen the greatest democratization in creativity since the rise of moveable type, perhaps since the advent of spoken language. Recall that the period under consideration was preceded by the twentieth century's age of great information and media empires. Radio, television, computing, print, and film produced immense amounts of content, but only through a handful of control points. Each of those central nodes was accessible to, and profoundly shaped by, either capital accumulation, state power, or both. Censorship was normative. Creativity was restricted in effect to a handful of producers and a smaller number of decision makers. Apart from small fan communities, audiences were largely relegated to a passive role, be they readers, listeners, or viewers. The connection between production and consumption was broken, or at least drastically attenuated.

"The networked digital world upended that settlement. First, within twenty-five years the World Wide Web gave creation and distribution access to roughly one-third of the human race: those with some measure of access to computers and networks. Second, the wave of mobile devices carried digital networks to another third of humanity.

Crucially, people used them to create and share art and stories. Despite the opinions of some of my colleagues here, this is consistent with the historical record. Generally, whenever we invent new information or communication technologies, we quickly explore ways of creating art and telling stories through them. This is what the time line of invention shows, from moveable type to the paperback novel, radio to television, Web pages to mixed reality. What changed with this technological shift was the return of creation and publication to most people. Wikipedia, podcasts, independent games, the endless variety of mixed-reality levels, Facebook, and videos—to name a handful—were the creations of a range of people, from professionals to amateurs. While we did not see a single Michelangelo arise, we saw millions of demotic creators sharing their works worldwide. *Billions* were exposed to a new artistic ferment. I cannot think of a term to describe this fantastic step forward other than 'renaissance.'"

Some of the scholars nod agreement, while others rumble dissent. Around each of them flicker lights and small images. At a gesture from one professor an image widens until it displays another scholar, life sized. This image is unusually bright and retains some three-dimensional depth for the in-person group. Behind this flickering scholar is an office, where one can glimpse a desk, bookshelves, one large screen, and other bright images. He speaks, yet his voice emerges not from the projection but from devices around the room: "This is all well known. However, it paints a picture that is too skewed, even simplistic. You describe only the positive dimensions of this new mode of creative production without addressing the negative consequences and uses. Online bullying, trolling at scale, cyberwarfare, cybermobbing, misinformation, the decline of trust in media, videofakes—surely much of that creativity went to horrible uses, especially against vulnerable populations worldwide."

The proponent nods. "Quite true, as even the most cursory glance of history since 1991 reveals. But I think you misunderstand the nature of renaissances. While they represent extraordinary bursts of

human creativity, some of those artifacts and processes are often used as weapons. Think of how monarchs used great art to legitimate their frequently oppressive rules—the humanities for inhumane ends, as it were. Many sides in Europe's religious wars turned art into tools for interconfessional conflict. Some of the great textual works of art—*The Inferno*, *The Pilgrim's Progress*, and more—take pains to mock, demonize, and otherwise humiliate members of faith communities. Dante famously named and tormented his enemies for posterity. It is naïve to think that creativity is only a force for gentleness. Renaissances, I repeat, have never simply been joyous affairs of human flourishing."

Another scholar—this one in person—coughs and stands. "A fair assessment. Even a fair and balanced one." The reference only works for the older members of the group, who groan or chuckle. "Yet you leave out perhaps the greatest dimension of your renaissance. Speak, please, to its role in the educational revolution. How did the long creative boom alter the academy we now inhabit?"

* * *

A generation of digital creativity has added new media layers to college and university lives. Starting with Sir Tim Berners-Lee's release of the Web's technology to the world in 1991, faculty, students, and staff have increasingly participated in a new creative domain at global scale. Members of academic communities have digitized analog materials, built websites, crafted games, recorded podcasts, generated interactive exercises, created e-books, shot video, wrote code, and remixed multiple items into new syntheses. They have shared them across an ever-expanding network of networks, either within closed environments (intranets, learning management systems, email listservs) or with much broader audiences. In conferences, faculty are as likely to present video, code, simulations, or animations as papers and posters. This was by no means a universal transformation, naturally enough, as many academics did not energetically partake in these new opportunities for a variety of reasons, but the professoriate

became, in part, a multimedia production population in ways it had never been.

This creative upsurge grew because it was increasingly democratic. From the last decade of the twentieth century and into the first third of the twenty-first, the means of content production were more available, more accessible, and more powerful. Greater proportions of the educational community were able to make more materials. The implications of this shift have settled in in waves. Campuses had to expand their support structures: hardware, software, training, storage, and preservation. Academic fields struggled to assess the value of members' work. Faculty and administrators gradually came to terms with the way their students had become creators in multiple senses: as learners engaged in constructing meaning, as content creators engaging with audiences beyond the classroom, as copyright owners. Pedagogies and campus policies changed to accommodate this new reality, with constructivism winning new adherents. Libraries and campus digital venues increasingly shared (with permission) and celebrated student work. Libraries played a larger role in supportive community creativity, from advising on copyright to providing recording spaces and media technology, and archiving resources.[1]

These educational changes were responses to changes in the world, as career demands shifted. Students interested in journalism learned from professional journalists who sought to differentiate themselves from, or benefit from, citizen journalism. Those professionals also found themselves making more media, often as parts of production teams; those students studied these practices in the academy. Library schools expanded their curriculum concerning information and digital literacy as fake news spread. Political science and government programs developed curricula in digital communication; for those fields a major milestone occurred in 2012 as the Obama administration asked supporters nationwide to participate in a massive, distributed digital storytelling effort.[2] At the same time many professional categories blurred as journalists blogged, Hollywood used user-generated audio in movies, satirists raked their targets across media,

and transmedia storytelling moved across nearly every medium available. Colleges and universities dedicated to equipping students for lifelong careers had to adjust.

The automation revolution took creative work to new directions. Software's increasing creative powers spurred theoretical discussions within and beyond the academy of just what creativity meant, now that nonhuman forces could participate in the process. The nature of creativity became collaborative in new ways as projects took to include artificial intelligence alongside complementary human roles. After a California project combined AI with humans in a structured way to improve a team's analytical powers, dubbing the results "swarm intelligence," group work was forever changed.[3] Creators at all levels now had access to creative assistance as apps grew to edit images, compose music, write prose, and animate videos; colleges and universities added this capacity on top of their recently developed digital creativity layer. Industries again changed as automation revised professional roles; postsecondary institutions tracked and responded to these movements.

Campuses also had to respond to the dangers and human costs of the creative renaissance, as our virtual professor reminded us. Students sharing a 360-degree video with a global audience can win support as well as useful feedback. They can also receive abuse, up to and including death threats and doxing. The collaboration technologies that enable teams of faculty, staff, and students to collaborate on and off campus also carry the threat of bullying. Members of an academic community seeking media for their projects sometimes work through algorithms that exclude certain communities or warp results with bias. Campuses in this scenario explore many policies and practices to shield their populations from harm. The learning management system becomes a shielded space for students to communicate within, and grows in popularity. Information and digital literacy become central to the curriculum in order to help students navigate an increasingly fraught information landscape. Faculty add language to their syllabi concerning how to respond to online abuse.

Institutional variation in the renaissance scenario is not especially great as a formal level. All colleges and universities have to support their communities in creative work, with limitations being driven strongly by institutional resources. Research universities are more likely to support faculty in their investigation of new media possibilities and implications, from law to computer science to sociology. They explore new modes of digitally enabled scholarship, including video discussions, data sets with associated software, interactive narratives, immersive environments, and interpretive AI.

More teaching-centric institutions, such as community and liberal arts colleges, are likely to encourage faculty to publish in the scholarship of teaching, especially concerning digital creativity. Otherwise they focus on supporting faculty and students in the creative use of technology for teaching and learning. Many variations occur based on an institution's overall strategy, the stances of individual departments, and the temperament of faculty members, not to mention the interests of students. Some campuses may acquire a reputation for protecting their students from online abuse with greater strength and care, while others obtain the opposite, offering a wide-open, wild, and challenging experience with the rough-and-tumble online world. Libraries become central resources for renaissance learning, offering physical spaces and tools, archiving services, remixing guidance, and general creative consultation. Intercampus teaching and learning become normalized, given ready access to collaborative platforms and opportunities.

State universities in the renaissance operate in between the research- and teaching-intensive modalities, depending on their institutional mission. Some emphasize research, others teaching, and still others balance the two. Their public role changes their implementation of creative technologies. State or federal policies may restrict or compel their use of various platforms and practices, depending on political currents; that is, one government may pass laws preventing public institutions from using certain forms of social media, out of concern for abuse and privacy challenges, while another rewards colleges and

universities for expanding their use of digital technology in classes. At a public system level, interinstitutional collaboration speeds the use of creative tech by creating frameworks for intercampus teaching, resource creation, and resource sharing.

Students who were born during this renaissance tend to take the democratization of creativity in stride, as that media change describes their entire lives. They are accustomed to a wide range of art and stories produced by a diverse set of creators and creative industries. Most published media before they became teenagers. Most have friends that they have never met in real life. Their schooling experience has involved a great deal of media production and consumption. The utopian idea of the Internet as a safe place for individual and collective development is as foreign to them as the concept of the world before the Web.

11 Augmented Campus

In 2030, American higher education is divided by digital strategy. One stratum is entirely online, with classes offered digitally by either older, bricks-and-mortar institutions or newer and wholly online enterprises. Another type of institution consists of colleges attended largely by commuter students who attend classes but don't live on campus. The third portion of academia is residential and predicated upon face-to-face learning: for many it is the iconic representation of postsecondary learning. This is the familiar liberal arts college or state university, primarily teaching traditional-age undergraduates. Its engagement with the digital world has expanded, taking advantage of emerging technologies. We can call it the Augmented Campus.

For this scenario the major drivers of change are the rapid development of mixed reality, the computing paradigm based on a blend of augmented and mixed reality. We are working from the possibility that AR and MR can be working well at commodity and enterprise levels by 2030. Alternatively, users may have become as accustomed to glitches with "eyewear" as we are now with, say, the Windows computing platform or the many logistical pains of air travel. We also assume that blended and hybrid learning have become normative approaches in postsecondary teaching. Additionally, this scenario is predicated on even more interinstitutional competition for students. Lastly, we presume that a decade from now will see most people having become comfortable with daily interaction with cloud-based data and analytics.

To most effectively visualize the Augmented Campus and how it differs from our present-day colleges and universities, imagine yourself as a visitor on a tour. If we set foot on the grounds, we would see familiar buildings with some changes. Residence halls, administrative buildings, classrooms, the library, the wellness center are all there, but some have giant digital screens, externally mounted and presumably weatherproof. These displays portray features of student life, academics, and examples of faculty research. Other buildings seem to have fewer windows than we might expect. The residence halls are larger and more impressive looking than they are today.

The Augmented Campus population is also familiar yet slightly different. We walk among students, faculty, and staff striding, sitting, or talking, but more of them are wearing glasses than in the distant past of 2018. Those glasses have thicker frames, and some are connected to other devices with cords. Their lenses are not simply translucent, but display lights and colors. Some do not sport these glasses, but if we look closely, we can see in their eyes tiny flashes of light, which do not seem to interfere with walking or speaking.

Once we visit the library and borrow visitors' goggles, things become clear. The entire campus is saturated with augmented reality content and services. The population accesses AR through glasses or contact lenses (hence those tiny flashes). Through AR, faculty, staff, and students can interact with much of the Internet, including contemporary social media, class materials, shopping, and news from home. Audio plays from earbuds connected to glasses or contacts; tiny microphones pick up the wearer's spoken words.[1]

This population also accesses information about the immediate environment. Students can quickly see if their roommate is home by glancing in the direction of their residence hall or by asking a query. Faculty can similarly identify where a colleague has ended up or see where the shuttle bus is, even if it is not visible to the naked eye. IT staff readily spot network outages. Librarians can discern movements of items from their physical collection. Prospective students and their parents scroll through information about campus social nodes,

institutional history, and the location of favorite classes. Meanwhile, all are uploading information passively through their motions and interface actions, the data hosted by various cloud services. The population can also add more active content through voice and gesture inputs and expressions.

Our tour now heads to an academic building. One fellow visitor wonders whether classes will be different than this augmented quad space. In many ways they are. Several classrooms do not contain whiteboards or projection screens, as it seems students perceive that content entirely through their eyewear. Other classrooms are nearly coated in displays that wrap around all walls, including doors, tables, ceilings, floors, and even the backs of chairs.

It's hard to find lectures that are actually occurring, though, as most classrooms appear chaotic to our visitors. Instead of rows of students facing a speaking instructor, students mill around tables and whiteboards, arguing with each other or gesticulating toward displays or at things we cannot see ourselves. Some are furiously typing in the air or on their arms, while others quietly talk to themselves. Others operate scientific machinery or art supplies on tables, although occasionally they seem to be pointing to or even manipulating spots in empty space.

Each of the classrooms has one or two instructors, but they aren't the center of attention when we first enter this building. Instead the professors move among the students, listening to or quickly advising them. Eventually we see one instructor in what looks like an art class mount a podium that, while plainly visible, doesn't dominate the class space. She delivers a three-minute talk about a misunderstanding under which most of the class is laboring, then explains the truth, pointing them to the next steps. Students pay some attention. When her presentation is complete, students return to their tables, walls, each other, and (to us) empty air. After an hour, one of our fellow visitors observes that the ratio of "chaos time" to lectures in minutes is about five to one.

Our campus tour now exits the academic building to explore other parts of Augmented Campus. We walk across the quad toward the residence halls. Along the way we see more signs of students, faculty, and staff engaging what would look like an invisible world, without the AR goggles. We listen quietly to what some of them are saying, and ask others what they're doing as they move outside. The answers include reminding students about overdue work, chatting with friends, working with mental health staff, and singing for a friend's new song. As ever, some students sprawl on the grass, but instead of poring over a printed book, they scroll through e-books or (or listen to) lectures presented from their glasses and contacts to their eyes and ears. (Some of these working and sprawling students are not physically present, as we can determine by lifting our visitors' goggles. They are distant learners, whose analog location can be anywhere on Earth.)

Along the way we walk past what seems to be nonacademic buildings. There are the familiar climbing walls, formal gardens, and sports fields. Two students are attempting to kayak down the creek that runs alongside the quad. Other students are delightfully racing about the lawns, shouting at each other, waving their hands. Their behavior is incomprehensible until we slip the goggles back on and see that virtual monsters surround the students, who battle or command them frantically. The students now look different, clothed in weird armor; their bodies have changed, becoming new species or genders. At times a student will grab a meter-long key from the air, and disappear it into a dimensional pocket. Another student somehow produces a fiery sword longer than he is tall.

If we lift our eyes from the immediate vista and look about, we can see that the campus is speckled with imagined and social fantasies. A gorgeous and impossible castle towers over one residence hall. One student harmlessly caroms a somewhat pixilated basketball off the tangible side of Colas Hall. A flock of cryptic robots, each named after their student creators, marches around the library. Historical figures wait patiently on footpaths, while a set of enormous DNA

molecules interfere with the parking lot. Artifacts we can't understand tumble and glimmer under the afternoon sun.

Alongside these fantasies the more prosaic world of campus history is available in meticulous detail. With a spoken command, visitors and residents can scroll a building back in time through the years, seeing additions, repairs, construction, and the pre-architectural site. Faculty from decades past can be summoned into their old offices, along with information about their classes, research, and personality. Planners can also scroll the campus forward, examining and displaying how things might look with a new building or refurbished current one.

The Augmented Campus isn't all fun. Several people look pained as they interact with virtual figures. One weeps openly, then slowly walks toward the wellness center. Several students are immersed in conversation with staff members, but we can't hear them; either their conversation is entirely virtual, or their eyewear has somehow muted their voices. It is not unlike observing residents of a major city, each exhibiting a range of moods.

Are these students unhappier than they were in the past? We visitors discuss this as we stroll. They seem to have greater access to mental health services than we do. Does that mean the campus has helped a larger number of students come to terms with otherwise suppressed issues, or is there a kind of social contagion of desire for therapy? Are we statistically confused because there are, according to the goggles, fewer students here than there were in 2018?

* * *

Let us take off the goggles, exit Augmented Campus, and return to our present. What did we just glimpse?

It is a campus where blended learning and augmented reality have synthesized and become mainstream. This population is comfortable living in a thoroughly intertwined dual reality, where virtual and physical content coexists as comfortably as digital movies inhabit

DVD cases today. Here users toggle between worlds much the way bifocal wearers switch depth of field.

Academics are deeply blended now. Classrooms and pedagogies are designed to this "bifocal" experience. Flipped learning is the norm. Lectures have receded, either becoming accessible online and out of class or delivered live, on spec, and in small doses, in order to address an emergent and local issue, as well as to (hopefully) inspire students to carry on in their work. Nonacademic or student life services are also blended. Students can access a range of entertainment in both analog and digital forms, and they are comfortable weaving one among strands of the other. They also access other forms of care, including counseling and managed social interaction.

The campus's built environment has changed, but not radically. There are fewer windows because people can layer their walls and rooms with virtual images and objects; windows can actually become difficult for digital overlays, and some people prefer blank walls. Others prefer natural light for the rich contrast with MR displays. Classroom interiors are more like studios and less like theaters. The outdoor spaces offer more entertainment in both modes, augmented and analog.

Campuses are managed somewhat differently than they are now. They devote more resources than ever to make student life attractive, as demographic, economic, and cultural shifts have depressed the higher education market. Faculty now perform multiple roles as instructors, student support aids, and campus guides; many administrative staff also offer campus guidance and support services. Professional development combines the fields of disciplines, student life, institutional research, law, and therapy.

We began this chapter by describing three higher education strata: the traditional bricks-and-mortar campus, the online academy, and Augmented Campus. Of today's postsecondary institutions, the ones most likely to enter the third category are those with a residential student body: liberal arts colleges, research universities, and many

state universities. Campuses serving a commuting population are far less likely to invest in a fully augmented layer, although most will provide a minimum of AR and MR services.

Some campus leaders view this new order as akin to the historical transition movie theaters went through. When would-be viewers could access visual content in their homes or on personal devices, theaters had to make the moviegoing experience much more attractive in order to compete and survive. They had to pitch themselves as worth visiting, worth spending extra money for. Similarly, the Augmented Campus offers a lavish experience. Certainly an eighteen-year-old can access a universe of learning from electronic devices (eyewear and other) without leaving home, but the Augmented Campus is much more attentive and engaging.

An eighteen-year-old who grew up in a world containing many Augmented Campuses learned to live in a blended world. From childhood on, the virtual/analog mix was simply part of life. In primary and secondary schooling, students coming from the most fortunate backgrounds (wealthier, more educated, white or Asian) are likely to have escaped the testing regime that preceded them. Instead they grew up on project-based learning, and so see Augmented Campus as a comfortable and natural place. For those who grew up in less fortunate circumstances, Augmented Campus may be disorienting, requiring some training and support. Creative eighteen-year-olds in this world see blank spaces, such as undecorated walls or unoccupied rooms, as desirable as canvas is to a painter: sites for work, creativity, and play. Intergenerational conflict appears when they find their pre-blended-world elders to be variously alien, hilarious, fascinating, or pathetic.

12 Siri, Tutor Me

In the year 2030, automation has powerfully reshaped postsecondary teaching and learning. Not only have curricula and pedagogies changed, but also the operations and scale of universities have been transformed. This scenario is based primarily on extrapolating a continued improvement of artificial intelligence in multiple forms. That improvement is understood to be incremental, without allowing for dramatic breakthroughs. Secondarily, the scenario depends on continued development of learning analytics. In this scenario students have access to tutoring software for multiple purposes. Such applications present information to students, then assess their responses using narrow artificial intelligence. They calculate how much new information to offer based on Vygotsky's "zone of proximal development," setting out enough content to be challenging and requiring some pedagogical assistance, but not so much as to overwhelm.[1]

Such tutorware assesses both student responses to new material and their grasp of all the information that has been presented, shaping new exercises to meet a learner's individual difficulties. There are many different forms of tutorware available in 2030. Most is aimed at the more quantitatively intense or fact-oriented parts of the curriculum, such as STEM fields, foreign languages (vocabulary and grammar), and history (events, less interpretation). Some can be set to monitor a learner's environment for content, as when a Russian-language application scans the sonic environment, looking for spoken Russian to record and play back later, or a meteorology program

checks for temperature and humidity variations to use in future exercises. Depending on the publisher, some of these apps can interact with other software, looking for relevant content to add to the learning experience. Social functionality varies according to the publisher and user, with different levels of sharing one's learning: achievements posted to social media, for example.

There is a range of multimedia format and style among tutor apps, from mixed reality to gamified interfaces. Audio interfaces are popular, so we can see people listening and speaking to AI tutors in their pockets, glasses, or on their wrists. This describes commodity software, standalone programs that individuals can install and interact with, but it is not unreasonable to forecast enterprise tutorware. A college or university can run such teaching programs at the institutional level. Running an advanced algebra program for an entire undergraduate population would likely be less expensive at such scale. Moreover, campus academic computing can aggregate data about student learning across these programs, which can then translate into advising, faculty development, and curricular revision, partnering with third-party tutorware providers. At the enterprise level this kind of digital "tutoring" may not appear as a distinct application by that name but may instead become a function embedded within other applications and services.

The learning management system of 2030 may well include tutorware that presents content and generates assessments within a class. Plagiarism detection services could run tutoring modules to instruct students, while gathering information on student issues with intellectual honesty. Library software may offer information or digital literacy instruction. Tutorware does not render human instructors wholly obsolete in 2030. In many cases faculty work with software in a complementary way, sometimes dubbed "cyborg" teaching. Professors shift certain teaching tasks to tutorware, especially those focused on factual recollection, easily verified responses, and certain grading. This frees up instructors' time to spend on other, less easily automated pedagogical functions: discussions, relationship building,

creative work. For example, a language professor outsources vocabulary drilling and grammar checking to a tutorbot, which allows her to spend more time teaching culture and helping students with creative media work.

But the advent of such software has also led to some learning without human instructors. Any curious person with access to relevant technologies can start exploring a subject on their own, perhaps choosing tutorware over a local community college's in-person classes or any online, human-led section. This technology has proven a boon for many students already enrolled in colleges and universities that lack coverage in those topics, such as less commonly taught languages and certain histories or sciences. At some campuses, especially those that are smaller or located in remote areas, individual students can take "tutorware study" classes, which can be recognized with academic credit, much like independent study has for generations. At other campuses, especially those whose leaders see financial pressures reaching stressful or crisis levels, certain faculty members are replaced by tutoring software. The cost savings are usually evident, even with enterprise tutorware. At times the replacement is cast as a humanitarian move, such as when the exiting instructor is an adjunct. At other times flexibility is the aegis under which the human-to-bot switch occurs, as the software can run at any time.

One version of the replacement model draws on Virginia Tech's Math Emporium experience. Launched in 1997, the Math Emporium offers an unusual space. It consists of hundreds of computers located on tables that enable easy group work. Each machine contains a rich variety of math software, including tutorials. Students assigned to the emporium work by themselves or in small groups, focusing on digital math tools. When they encounter a problem they can't solve, they flag one of dozens of tutors who staff the facility. Over the years this unusual learning space has helped Virginia Tech students learn math more effectively. We can imagine that model applied across the curriculum, based on tutorware and independent of a physical site. Students taking introductory macroeconomics, basic Spanish, or second-year

chemistry can work on their subjects by interacting with the appropriate digital tutor, using the technologies that best suit them. When a learner reaches a problem that stymies them and their technological assistant, they can summon a human tutor for help, either connecting with them online through videoconference or virtual reality, or in person by means of scheduled appointment. The total cost to the institution is less, which enables the possibility of reducing tuition.

The higher education landscape in 2030 therefore presents some different contours than it did in 2019. There are fewer faculty members working for many colleges and universities, and students spend more time interacting with technology. Adjunctification will have grown by 2030, as more campuses follow the Math Emporium model and find part-time human tutors a better investment than a tenured faculty member. There may as well be fewer students, as competent commodity tutorware competes with university tuition. We can imagine software ad campaigns ("Why go into debt when My Personal Astronomer can teach you for the price of a single download?") as well as popular discussions ("Why should I pay this school to teach me with a digital tutor when I can get the same results for far less money and without leaving my living room?"). For this reason some campuses avoid or block tutorware, and instead advertise themselves as more humane institutions of learning. Faculty routinely protest and critique software firms that offer such products.

Elsewhere on campus, tutorware appears unevenly across the curriculum, as a kind of C.P. Snow Two Cultures implementation divide occurs. It is generally easier to automate the sciences and more quantitatively intensive social sciences than the humanities and arts, so faculty at some colleges and universities in the latter disciplines outnumber those in the former. Computer science departments and allied fields (robotics, human–computer interaction, digital media production) experience massive growth driven by the emergence of a tutorware industry. Campus IT departments devote a significant chunk of their resources to tutorware support. They must select and maintain enterprise software while at the same time developing data-

gathering and analysis tools. IT must also help students connect the tutors that they brought with them from high school or workplaces to the campus network, a complex and ramifying task as the industry grows and develops. Faculty members, advisors, and educational technologists work with students to familiarize them with new tutor technologies and pedagogies.

The range of available software causes new challenges, and not just from the sheer number and variety of tools. Some students will appear on campus having been taught with tutorware designed for purposes beyond the curriculum: science software that avoids evolution, programs that emphasized contributions from one population over another, out-of-date or simply low-quality applications. Some providers market themselves to niche populations precisely for these reasons ("Our mathware will never teach your child about secular humanism!" "Learn history from *your* country's traditional perspective!"). Faculty members will come to know and dread certain brands while respecting others. Other students may have sentimental attachments to tutors, much like to a family pet or plush toy, bringing them to campus; unlike pets or toys, these beloved applications may cause problems for an institution's information architecture.

Research universities emphasize AI tutors for their research work, developing them first for faculty creating scholarship, then for graduate students. These are not tutors so much as research assistants, performing useful tasks in the service of inquiry: assembling bibliographies, running automated experiments, data-mining research corpora, producing visualizations. Students at these campuses learn how to work with researchware as part of their studies; for some this learning is part of a tacit curriculum, while for others it is a formal step on the way to a diploma. Teaching-centered colleges and universities assign such researchware to faculty for their research but also deploy pedagogical software that helps instructors facilitate student learning. Such software connects the multiple data streams generated by students and their tutors, producing analyses and visualizations to guide classes. Liberal arts college and community college IT

departments devote significant resources to maintaining this software ecosystem.

Libraries and campus counsel also play key roles in shaping data storage and privacy policies. State universities must address the significant regulatory hurdles in deploying tutorware. As public entities they are subject to state policies and laws concerning privacy, safety, and procurement. They may well fall behind their private counterparts. The development of this tutorware world would have certain impacts on those who will turn eighteen in 2030. They may have taken expanded study halls in high school, as those schools expanded their curriculum with software or saved their district funds by swapping human teachers with an app. As mentioned previously, the student born in 2012 may grow up expecting decent or wise tutors, a digital Dumbledore or Socrates that carried them through difficult classes. Yet members of this new generation may value human beings more than their elders do, precisely for the things they display that software cannot yet realize: unpredictable personality, and being bound to certain times and locations in the physical world.

How can such a future world of postsecondary education occur? Obviously it depends on major progress in AI over more than a decade, but this does not require a drastic act of imagination. The tutorware described in this scenario falls far short of a general-purpose AI, much less posthuman software. Instead, we can see tutorware emerging through a continuation of the current wave of AI developments, a mix of incremental improvements and some conceptual advancements. The continued progress of human–computer interface (HCI) thinking and implementation has made dinosaur programs like Siri and Alexa seem painfully constrained. Further research and application of learning science have empowered both HCI and AI, showing programmers and algorithms alike better ways to inform human beings. Each of these has informed the other, leading to a virtuous circle of development.

Naturally some researchers and other workers in these fields have taught themselves with their own tutors. Beyond the rise of the tu-

torware industry, other developments help frame this scenario. Commercial, governmental, and academic AI projects have been working to give those seeking to build digital instruction more and innovative tools to work with. Groundbreaking projects like the Open Learning Initiative project or the Duolingo app inspire more creativity and practice.[2] The growing world of open content, including open education resources and open access in scholarly publication, has given AI in general and tutorware in particular much material to draw upon, learn from, and practice with. The massively growing amounts of big data have also provided rich fodder for automation (this is an area where China might outpace the world, given its size and organization).[3] Students who grew up in a Tutor Me, Siri world have long been accustomed to learning from software. Digital tutorials constitute part of their information experience. Some are attached to tutorware in certain subjects, such as those that matter the most to them or that were entertaining. They appreciate human instructors to the extent that they either differ from software or reproduce tutorware's best features.

13 Retro Campus

In this scenario we envision a university in the year 2030 that has struggled mightily to recapture the campus of 2000, or even that of 1990. That institutional transformation represents a deliberate strategy to preserve what some campus leaders value of the academic tradition while resisting certain features of the outside world. The Retro Campus constitutes a sustained withdrawal from most of today's networked digital world.

The main driver of change behind this scenario is resistance to digital technology. This includes academic criticism of the online world as well as the integration of technology with teaching and research. It also builds upon general opposition to the growing financial and cultural clout of Silicon Valley, in addition to criticisms of people suffering from too much screen time or digital device manipulation.

The Retro Campus physically resembles the late twentieth-century college campus, albeit with more buildings appearing in various postmodern architectural styles. Residence halls, administrative buildings, academic buildings, wellness centers, libraries, field houses, alumni houses, and career centers are all present, depending on the institution's wealth and structure, but they lack the exterior digital displays that we sometimes see in the outside world's built environment. Students, faculty, and staff stroll brick-lined sidewalks and grassy quads, less likely to be seen using smartphones or tablets than they would be off campus.

Secure, well lit, and visible lockers for mobile devices are available at key points on the edge of campus, as well as in the campus library. Some of these lockers are accessible by analog keys, each neatly emblazoned by the institution's logo or mascot. Other lockers offer power charging for detained devices. Signs encourage or warn people to take advantage of these resting places. Classroom buildings also have device lockers just inside their main entrances and next to the doors for some classrooms, especially those of large lecture halls. Depending on the university, students are either strongly encouraged or mandated to place devices there before entering class. Many lockers bear the campus logo, while others are visibly sustained by campus organizations, including sports teams, service groups, fraternities, and sororities.

Classrooms look much like those of 2018, except that they have fewer digital devices. Instructors write and sketch on noninteractive whiteboards primarily, although some are from offline PowerPoint files or from books projected to a computer or overhead projector by a document camera. Some classrooms have a smartboard to display documents. Students take notes with pen, pencil, and paper. Some classes have students writing in printed workbooks and paper handouts. Certain classrooms are designated "no network access" spaces, occasionally reinforced by surrounding Faraday cages.

The pedagogies on Retro Campus are also aimed at the past, based on removing practices that were powered by digital technologies. There are few active learning classes, fewer instances of project-based learning, and classes not in the humanities remain unflipped. Humanists insist that they are the original flippers, since a core teaching practice has long been seminar discussions. Scientists alternate classes between large lectures and hands-on lab sections. There are fewer e-reserves (accessing them is the main function of the learning management system), and most instructors and librarians discourage students from researching on the open Web, especially on Wikipedia. Large lectures continue to occur, but without clickers or

laptops in the audience, and also without being digitally recorded by the institution.

Makerspaces are lively presences on Retro Campus. Students interact with each other and with other members of the community (both academic and local) as they explore predigital technologies. They learn about woodworking, sewing, tinsmithing, and working on engine parts from each other, from older practitioners, and from much older printed material. They tend to avoid using laptops, phones, or other devices for information and to document their work. Makerspaces are one part do-it-yourself zones, one part historical reenactment.

Scholarly communication practices also resemble those found in the late twentieth century. Most researchers have stepped back from blogging and social media. Few maintain Web content beyond basic departmental online profiles. Most of their reading takes place either in print (journal issues, monographs) or through proprietary sources (databases, scholarly society publications). Many highly value face-to-face professional meetings, seeing them as thoughtful refuges from a device-addled world. They leave their laptops in their hotel rooms and resist the temptation to check their phones during sessions.

Campus IT departments have changed greatly since 2018. Their services have dwindled. They also now have a defensive mission aimed at keeping the population from digital overuse. After all, someone has to make sure the device storage lockers are maintained and the Faraday cages are powered up. Someone has to research emerging digital threats and how best to counter them.

The Internet of Things is scarcely present. Digitization efforts have paused. Blockchain doesn't occur here, nor does badging; all certification is by diploma, printed on sheepskin (real or synthetic, depending on the campus). Few faculty connect with the digital humanities movement, and fewer still speak of it.

Language changes often indicate social transformation, and we can see that at work in how people describe this new/old institution. "Retro Campus" is one name for the new university, but there are others that reveal different attitudes. "Luddite U" is sometimes lobbed

sarcastically, but it's a moniker stated with pride by those who see the struggle over new technologies as economic or existential threats. Some use the less violent "Amish College" to emphasize keeping an older way of being alive in the teeth of a society busily doing the wrong things. There is also "Justice Campus," which keeps people safe from the injustices of the online world, in particular the digital abuse meted disproportionately to women, people of color, and gender or sexual minorities.

Retro campus cultures sometimes make a point of recalling the 1990s. Students will try out that period's clothing or attempt dancing to its music. The Clinton administration is often aired with a sense of nostalgia. Classes about the end of the Cold War or the early Web often fill up.

What is driving interest in the Retro Campus? Security threats played a role in moving campuses away from the twenty-first-century digital environment. Fears of hacking, data and identity theft, phishing, and more prompted campus leaders to consider the online world as simply too dangerous to inhabit, much as study-abroad programs avoid sending students to nations that the US State Department deems unsafe. Concerns about businesses and governments misusing data for profit or surveillance added to this reaction. Every major data scandal drives Retro Campus one step closer to reality.

Another driver for Retro Campus is the belief that modern digital technology has become toxic. Mobile devices are addictive. Social media supports too many horrible things, such as threats to individuals and groups, the publication of offensive content, and representation that poorly reflects social realities. There's a general sense that the huge companies behind modern tech (Apple, Amazon, Facebook, Google, Twitter) are deliberately benefitting from users' distraction and misery and therefore should not be supported. Retro Campus is designed to wall off this toxic Internet, creating instead an alternate space for learning and knowledge that is safer and better for all.

Gathering and analyzing student data have come to be seen as part of this toxic Internet. Many faculty, students, and staff fear that

third-party providers can't be trusted with data. They worry about their own campus IT departments and their ability to protect data from attackers. They view data analytics as dataveillance, as dehumanizing surveillance, preparing students for Skinner boxes rather than for lives as well-rounded and thoughtful human beings.[1] Some argue that data analytics is a poor and unjust substitution for a pedagogy of care.

A failure of the open movement could further drive Retro. If open education resources don't manage to win the support of the professoriate, textbook prices will remain high or increase further. The digital world, where OER dwells, will offer no alternative. If open access to scholarly articles and books fails to win over researchers, established and proprietary publishers will lack incentives to innovate and can easily fall back on their twentieth-century models. Much like most e-books are effectively PDFs or text files without additional features, scholarly materials won't offer any new affordances in their digital incarnations, reducing faculty interest in networked scholarship.

Some students bring retro interests to Retro Campus. Older students can take comfort in returning to what they perceive as the academic life they knew of years ago. In contrast, some millennials and members of Generation Z enjoy analog technologies for their novelty, from vinyl records to physically making chapbooks, and Retro Campus appeals to that instinct. They see Luddite U as a fun alternative to the digital world they otherwise inhabit.[2] Additionally, some students dislike the flipped or active classroom, preferring the classic combination of lecture and homework.

Demographics help build this university to some degree, as the most digitally immersed and youthful generation occupies an ever-shrinking portion of the total population and as older students become more prevalent on campuses. Even millennials, the first net.generation, accept Retro U as a pleasant alternative to their digitally drenched adult lives. On the other end of the demographic scale, some of the oldest faculty, staff, and students invoke the Amish, arguing that technology-

centered education is a mistake, a sign of a world having gone too far with digital innovation. Some have never practically adjusted to key parts of the digital world and see resistance to it as both ethical and in the best interests of postsecondary education.

Not all institutional types can mount a full retro approach to higher education. Professional schools and community colleges offer too many classes and programs that rely heavily on digital technology. Much research still requires digital networks and devices to proceed. Instead, the campuses most likely to become retro universities are those that see themselves as not being explicitly about job preparation, but focused instead on personal development in a safe setting. Some liberal arts and religiously oriented colleges may be best suited for the retro approach.

On Retro Campus a typical eighteen-year-old expects higher education to offer a throwback space, much like a vinyl record store, an artisanal movie rental shop, or districts on the wrong side of the digital divide, such as rural areas. For some, this is an unappealing space and would either discourage them from applying to colleges and universities or would constitute an unacceptable price to pay for postsecondary learning. For others, Retro University appears as an exciting change of pace, or even a challenge along the lines of Outward Bound. For this rising generation, informal learning is thoroughly digital, while formal learning is largely analog.

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To the Future and the Present

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14 Beyond 2035

Having covered the next decade and a half of American higher education, in this section we extend our analysis to encompass the subsequent postsecondary generation. In other words, we can attempt to forecast beyond 2035.

If exploring the near- and medium-term futures of colleges and universities is both daunting and requiring of extensive analysis, to attempt to look further ahead should inspire true humility. Starting with the largest possible scale of analysis—planetary civilization—involves modeling the possible effects of climate change, which already necessitates an enormous scientific endeavor. That research has established the likelihood of a 1- or 2-degree centigrade temperature rise over the next few decades, warming that could drive larger numbers of climate refugees to move across international borders. Similar movements over the past few years have already changed the face of politics in Europe; we can anticipate at least as much social and cultural stress on top of large-scale human suffering. This temperature rise is likely to trigger agricultural crises stemming from crop failures due to excessive warmth or encroaching aridification; that, too, could inspire political, economic, and social unrest. Anticipating and mitigating these possibilities—should a given polity decide to do so—then stimulate yet another level of political, economic, and social change.

Looking at change drivers for geopolitical structures and events other than those caused by the Earth's changing climate involves a

small galaxy of possibilities. We have touched on several of these throughout this book: the growing age gap between developed and developing nations; rising and unevenly distributed income and wealth inequality; the tension between those seeking to extend and deepen globalization versus neonationalists and localists; growing illiberalism in many political environments; areas of rising religious belief and practice versus regions of growing religious unaffiliation;[1] the battle between corruption and law enforcement; the continued struggle for women's rights; and traffic in multiple illegal substances. All of these challenges, and more, offer ways for shaking or reaffirming certain elements of the world order. Individual nations and regions provide myriad opportunities for change, too, from longstanding border tensions (Israel and its Arab neighbors; China and India; India and Pakistan) to political instability (sub-Saharan Africa, some of the Middle East) to transcontinental projects (China's One Belt One Road initiative). The number of possible alterations to the present-day political settlement ramify accordingly.

Alongside and intertwined with these forces is the ongoing technological revolution, a domain that offers yet another realm of colossal complexity. Attempting to forecast the digital world of 2035 from 2018, a gap of nearly twenty years, runs risks along the lines of anticipating the technological environment of 2018 from that of 2001. In 2001 most Americans were slow to imagine the mobile revolution, even while mobile phones swept the rest of the world. The dot.com bubble had just burst, which chastened many formerly expansive imaginings. Virtual reality of the 1990s had failed massively, and few saw it proceeding again. The Web was growing rapidly but remained largely in its noninteractive, document-centric mode; the more social, easier-to-publish environment of what would be dubbed "Web 2.0" was just beginning to surface.

If we wish to look beyond 2035, we would do well to augment our caution even further and imagine glimpsing 2018 from as far back as 1984. Visionaries of the Cold War's last decade did manage to foresee certain features of our time. Futurists like Alvin Toffler au-

gured a shift away from manufacturing and toward a postindustrial economy, which has largely transpired, at least in the developed world. Others focused on the looming threat of nuclear war. Most failed to pay attention to China's recovery from its cultural revolution and turn toward modified capitalism, which would become one of the great stories of our time.[2] Science fiction writers of the then-emergent cyberpunk school presciently envisioned a deeply networked future world dominated by large corporations and suffering from threats to civil liberties. But those writers largely missed mobile devices, tended to overstate the actual realization of artificial intelligence, and did not foresee the world-changing World Wide Web. Looking back at historical futuring gives us some retrospective caution in looking forward now.

Cautiously, we can suggest some technological possibilities based on the frameworks that seem most durable today and on extrapolating from some current initiatives. The fourth industrial revolution model, for example, posits continued movement away from a classic manufacturing-based economy and toward a society reshaped by multiple forms of new technologies, mostly automation from AI to robotics. There are many powerful forces driving such a transformation in the present, as discussed in chapters 4 and 5. There is a great deal of cultural and financial capital invested in this revolution.[3] Technological invention continues to progress. If we assume only incremental advances along these developmental lines, rather than chaotic disruptions, we should anticipate a transformed world, with a baseline of widespread do-it-yourself manufacturing, artificial assistants, use of robotics in professional and personal lives, and rich multimedia production and experience.[4]

We should also anticipate a range of cultural responses to a fourth industrial revolution. Automation alone offers multiple ways forward, assuming that set of technologies and practices succeeds on its own terms (and the possibility of a major automation crash is one we should anticipate). For example, we have already imagined, and are presently working toward, various forms of recapitulating a degree

of human identity in silicon. One concept involves starting from the mass of expressions a given person creates during decades of life—text messages, emails, phone calls, blog posts, Instagram photos, video appearances, and so on—then using software to determine that person's distinct style, their expressive voice, in order to repeat it after death in a kind of machine learning memorial. Extrapolated one step further, we can envision virtual advisors from the past who assist us in our work, or grief therapy programs based on living people interacting with mimetic forms of the deceased. Another concept sees software simulating a more generic or less representational human being, a virtual person living a digital life, which can then be put to various uses from study to work; with some degree of autonomy, such emulations could well develop their own societies.[5]

Looking at this historical transformation from political and economic perspective, our present political and social arrangements and the historical record of the first through third industrial revolutions offer several different civilizational reconfigurations, as Peter Frase and others have suggested.[6] If automation renders many jobs obsolete, human creativity could respond by creating new functions, jobs, and professions for carbon-based life to perform. After all, hardware and software need some degree of managing, and the social impacts of automation will transform current human needs while creating new ones, which emergent professions could meet. Alternatively, automation's successes may be limited to ways of assisting rather than replacing people, enhancing work rather than outmoding workers. In this future we could work closely with machines in some form of cyborg relationship, either literally through implants and ingested devices, or metaphorically, as we come to depend ever more intensively on software, data, networks, and hardware to perform our various tasks. Machines would closely empower our work and lives.

We can also imagine a socioeconomic elite powered by automation and related industries, dominating a society consisting largely of disempowered poor or working-class people kept in line through a mixture of rich entertainment and ubiquitous surveillance. This could

become something nearly medieval in scope, with a social base of impoverished techno-peasantry and a vanishingly small middle class above it. Social media by itself would perform that mixture of pleasant distraction and data-driven monitoring. Other technologies could be pressed into service: AI for more ambitious data mining, robotics as a police force, and tiny networked devices for extensive surveillance. From this future we would look back and see the early twenty-first-century dystopian literature wave and the warnings of Carr, Lanier, et al. as eerily prescient.

In a less dystopian version of this automated inequality world, most workers would be free from many historical drudgeries, thanks to automation's successes, and leading healthier lives. In fact, some futurists see such a world as one positively liberated by automation. This is where the idea of a universal basic income (UBI) enters discussions, based on various plans to guarantee all residents (or citizens, a crucial difference) of a given nation or region a sufficient cash transfer to maintain a basic existence. UBI proponents often pitch their idea as a response to automation's capacity to render human workers obsolete and the possibility that we will not generate new professions. The average work week may fall from the classic forty hours to thirty or twenty. Alternatively, more people may alternate periods of full-time employment with seasons of unemployment. A UBI system would tide people over these compensation shortfalls. Moreover, without an existential requirement to work for pay, some of us may choose to pursue nonremunerative tasks, such as writing a novel, learning a foreign language, spending more hours caring for loved ones, or conducting a religious pilgrimage. UBI could spark new human potential: quite the knock-on effect from automation's potential triumph.

Automation could yield another range of possible midcentury worlds, wherein devices and software progress even further, augmenting the world with a posthuman ecosystem. Imagine machines handling many of today's human tasks, but better: hauling cargo in redesigned vehicles, growing crops, diagnosing human and animal

illnesses, building colonies on Mars and the moon, performing surgeries, all more safely and efficiently than humans could do. Software produces nonfiction and creative art, manages the economy, patiently counsels and instructs humans. We have seen horrific versions of this in fiction, such as Karl Capek's human-exterminating robots (1920), the "benevolent" tyranny of *Colossus* (1970), and the genocidal Skynet from the *Terminator* movies (1984, 1991, 2003), but popular culture has also produced positive visions of a posthuman society, such as Iain Banks's far-future *Culture* sequence (1987–2012). These fictions offer much speculative material but also bring to mind a deep question: faced with being outmoded by our technological creations, either kindly or with chilly indifference, how would humans react, psychologically and culturally? Would we rage against these devices, as Victor Frankenstein snarled against his much more articulate monster? Or would we instead accept our new status and launch a society-wide vacation, like in the film *Wall-E* (2008)? This is a question the university is supremely well suited to explore, given the intellectual depth of our many disciplines. We can now imagine a curriculum based to some degree on the emergence of a new, posthuman age, and how history, computer science, sociology, literature, philosophy, and economics might teach it.

Yet we must be cautious about these visions of the middle of the twenty-first century, since they are based primarily on certain ways we might restructure our world based on only one technological domain, that of automation. Consider instead the possible futures driven by other technologies currently in development. If we start from biological applications, we find a Facebook team that seems to be making progress in developing a device to allow hearing-impaired people to experience audio communications as haptic vibrations, either returning to them the sense of sound or producing a new, sixth sense. How else might we enhance the lives of the disabled, or instead (or additionally) extend the range of human experience?[7] Research into brain science has allowed early methods of physically intervening in human cognition, leading to explorations of altering mental

states, connecting minds directly to computers, or linking minds together. A device to enable brains to control devices wirelessly is being tested.[8] The potential for torment and abuse here is vast, as are, once more, the possibilities for expanding what humans can do in the world, not to mention exploring the old dream of teaching by sending information directly into the brain, like Neo experiences in *The Matrix* (1999). Meanwhile, the long-running field of genetic engineering, frequently the source of dystopian imagination (*Gattaca*, 1997) and ethical conundrums, is developing new powers through CRISPR technology. We can, perhaps, redefine human and overall biological life on Earth. Add other technologies and practices to this mix—psychopharmaceuticals, advanced artificial limbs and organs, 3D printed anatomy, the Internet of things installed within bodies—and what it means to be a human being in 2045 would be a radically different question than it did when posed in 2018. Once more, what other institution is better positioned to guide us through such extraordinary challenges than the academy? And to what extent will colleges and universities shape such a future through research, producing technologies, practices, and concepts?

At the same time the biological world may be further inflected by changes in large-scale material science and new projects. Ever-shrinking computational devices may lead us to mobile and networked machines small enough to be ingested, that can conduct medical work on the human body. Even at scales larger than the dreams of nanotechnology, we can imagine transforming the physical world through the deployment of networked mites too small to be seen by the naked eye, perhaps leading to the advent of materials that can be addressed remotely or function autonomously, or "smart matter." 3D printing could reshape aspects of our built environment, as might the use of new materials, like strong and light graphene. New materials may well be needed, as currently under consideration for mitigating climate change are massive geoengineering projects, such as adding saline to an entire ocean, building region-scale seawalls, altering the planetary atmosphere's chemical composition, or installing a massive

shade in deep space between the Earth and sun. To reach space at all, we currently use rockets, the dangers of which have elicited experiments and designs for everything from reusable spacecraft to atmosphere-straddling space elevators. New entities are participating in a twenty-first-century space race that barely resembles that of the twentieth century: corporations, billionaires, and nations building programs for the first time. These potential innovations or transformations could affect higher education in multiple ways, starting with altering a campus's physical plant. College curricula and student career services would likely develop programs to support learners who seek to work in those new fields. The development of any or all of these projects will draw heavily on academic research and development. Further, many university departments will be able to contribute to the selection and critical assessment of such epochal projects, from political science to philosophy and sociology.

All these possibilities are based on trends that we can perceive in the present day. Meanwhile, beyond those evident change drivers, black swan possibilities also lurk. Historical examples abound, such as a leader's sudden death by accident or assassination that unravels a political order.[9] A new religious sect or the vigorous reformation of an existing faith can win adherents and upend societies. Beyond political and social causes, a pandemic that exceeds our medical containment capacity could not only constitute a humanitarian disaster but also sap regimes, shock economies, and electrify cultures. Conversely, a medical innovation might save or extend lives, such as a cure for congestive heart failure or a therapy that ends Alzheimer's. Many natural disasters have so far been handled without disruption by our current national and international systems, but larger-scale ones are possible and potentially devastating, such as cometary or asteroid impact. Climate change proceeds slowly, yet an unlikely and sudden shock, such as the Atlantic Ocean's thermohaline circulation system shutting down, could yield a range of powerful impacts. Because black swan events are by nature challenging to anticipate, we

may well be hit by a completely unforeseen development, one that to us in 2018 is a Rumsfeldian unknown unknown.

Our digital world may be especially vulnerable to these low-probability, high-impact events. A solar coronal mass ejection of sufficient size could damage networks and devices over a large geographical range. An electromagnetic pulse could remove a target completely from the Internet and the electrically connected world for a short period of time, leading to potentially catastrophic results. Imagine a city or state not only forced offline (no banking, email, documents, voice calls) but also cut off from electricity (no lighting, refrigeration, air conditioning, use of cars or aircraft). The immediate medical consequences are, to pick but one result, dire. Digital attacks conducted by national governments and their military or intelligence agencies (cyberwar), by organized crime, by other nonstate actors, or by future organizations could crash major networks. If any of these occur at sufficient scale, a social disaster could unfold, given the deep dependency we now have on the digital world. Amid all these possibilities, and in all humility, we must consider the ways higher education might develop after 2040.

The global postsecondary education market that evolved during the late twentieth and early twenty-first century may well persist or expand if globalization's drivers continue. The invention and promulgation of communication technologies as well as the movement of capital and (to a more regulated extent) population across national borders are poised to continue intertwining and interconnecting the human race. This trend creates the infrastructure to support transnational teaching and research while contributing to the rising expectation of learning that is borderless, or at least border-light. The demand for learning that cannot be met locally for a range of reasons grows a potentially planetary reach for American colleges and universities.

Alternatively, we could see that global educational wave recede under the impact of antiglobal cultural and political movements. It

is not a stretch to envision calls for something like postsecondary educational autarky, with leaders celebrating "American universities for Americans! American research for America—first!" Universities may decide to reduce foreign pedagogical entanglements for fear of national security compromises, suspicions of terrorism being spread or terrorists harbored, or because of international economic competition involving intellectual property. A wide range of stakeholders, from students' families to politicians to donors, could well make such a case quite forcefully.

Yet demographics may keep American colleges and universities within a global marketplace. If the fertility and lifespan trends we discussed in chapter 3 persist, campuses that choose to serve traditional-age students will have to expand their recruitment abroad. In particular they will have to focus on the dwindling number of nations that continue to produce large numbers of children, especially those in Africa. That continent is already on track to be the source of more than one-half of global population growth until 2050. After that point, "Africa will be the main contributor to global population growth."[10] Given the primary and secondary school challenges many African nations face, perhaps American universities will partner with African schools to enhance their educational offerings, while at the same time recruiting students for their campuses, either in the United States or elsewhere. At present some American colleges and universities collaborate with nearby and regional high schools in many ways. They have long provided teachers and administrators; now they also offer dual-credit courses that enrich the high school experience while providing additional college preparation to those students. We can imagine universities participating in intercontinental K–12 support and enhancement projects, possibly in concert with global nonprofits or the World Bank.

Such transatlantic outreach is by no means certain. American racism could stymie the recruitment of Africans. Logistical costs for basing recruitment in African nations may prove too much for many institutions to bear. Moreover, the demographic changes reshaping

the developed world may well give rise to a call for American women to have more children, which, if heeded, could yield a midcentury youth boom to rival the mid-twentieth century's baby boom.[11] I find scenario this unlikely. It would take an extensive, enormous, and unprecedented cultural upheaval to undo several generations of changes in women's lives at the scale needed to produce such a population shift. Absent that, the future of American higher education may well be found in Africa.

The planetary higher education world could change under the impact of developments from another continent. By the middle of the twenty-first century, China could well compete with the United States for the position of world academic leader. That nation has already made tremendous strides since the academic catastrophe that followed its cultural revolution. In terms of research, China has already become a technological powerhouse. It finally became a leading superconducting chip manufacturer after years of having to rely on the United States, South Korea, and, most embarrassingly, Taiwan.[12] In 2018 the nation passed one major milestone, when fifty-one of *Nature*'s one hundred worldwide "rising star" universities in the natural sciences were Chinese.[13] The combination of academic and industrial innovation has already positioned China as competing with the United States for leadership in quantum computing, robotics, and AI.[14] China is now aggressively expanding its influence abroad, most notably through the multicontinental One Belt One Road initiative.

We could imagine China outpacing the United States in the global education marketplace, especially if machine translation reduces the Chinese language barrier. Other factors would have to fall in line, too, such as the rest of the world coming to terms with Beijing's political surveillance and America failing to grow its research output. Alternatively, China's growth curve could reverse under the impact of multiple contingencies (the end of economic growth, domestic unrest, global dislike of digital authoritarianism, successful American geopolitical strategy). A transpacific academic competition between two postsecondary giants may frame the global development of

universities worldwide as well as form a major influence on American academia.

This combination of geopolitics and academia may surprise some readers, but it is not new. American higher education has long played a role in international relations, from serving as a base for academics fleeing Nazi Europe to conducting scientific and military research during the Cold War. As of this writing the post-9/11 War on Terror continues to be fought around the world, with multiple impacts on higher education; it is no imaginative stretch to see it persisting for years to come. Other international dynamics could connect with academia over the next generation. Think, for example, of the likely rush to exploit undersea resources that are now more accessible with the Arctic ice cap's retreat, which could elicit the expansion or development of new academic programs. Consider the rising tensions between the United States and Russia over multiple issues, which could lead to academic embargoes, the breaking up of scholarly partnerships, or perhaps the creation of a Moscow-centric and -friendly network of international universities.

Domestically, a range of political trends and events could adjust the contours of American higher education by midcentury. Economic politics have become more intense since the 1990s, especially after the 2008 financial crisis and the dissemination of recent research into income and wealth inequality. A rising political left, signaled by Occupy Wall Street and the 2016 presidential campaign of Bernie Sanders, could push for expanded public support for college tuition. At the same time, an elite whose wealth increasingly removes it from the rest of society may enjoy and support an ever more separate education system, from primary school through graduate programs. The combination could yield a class-based political polarization along the lines of the 1890s and the Progressive Era.

The anticipation of climate change's impacts could lead colleges and universities to take an active role in weather and oceanic mitigation. It could take the form of campus-built retaining walls and shelters for coastal institutions (recall how many American colleges

and universities are on the Atlantic and Pacific Seaboards). Alternatively, endangered campuses may choose to migrate inland and upward, away from rising tides and social upheaval.

Environmental pressures may drive a different set of social forces. The specter of vast amounts of waste products accumulating worldwide, from cities to oceanic garbage archipelagos, has drawn calls to rethink contemporary economics. Some have created models of a circular economy, where economic growth no longer occurs but currently existing materials are cannily reused and repurposed. Such a society would embrace an end to producing more, instead seeking to maximize what we already have. Similarly, the looming crisis of global warming has inspired others to embrace the idea of cutting back on carbon-spewing industrial production altogether, aiming for the idea of economic degrowth. Only through reducing economic output do we have a chance of repairing the damages wrought by the Anthropocene.[15] Obviously a turn to either reduced growth or the circular economy would cause vast social changes. Academia would not be immune, especially as many environmental and economic ideas emerge from universities. Institutional business models would have to shift in such a context. The way by which a degree constitutes preparation for a career would also be transformed.

Struggles over gender and racial inequalities could easily drive social and academic changes for the next two generations. As of this writing, progressive visions of gender and racial equity clash fiercely with opposition worldwide, from traditional societies to a wide range of conservative ideologies. Redefinitions of gender as social performance and in terms of nonbinary identity have prompted similar resistance. Governmental policies, social mores, and the lived practice of everyday life may all be contested, and their transformations drive further change. Higher education is naturally part of this process. Changing attitudes about gender and race play out across classes, research, and student life, while academia plays some role in influencing the broader social dynamics, sometimes as a thought or practice leader. Will higher education institutions differentiate themselves

from each other by their policies in this domain? To what extent will changing mores and politics drive further academic change?

Meanwhile, health care may loom ever larger as a social problem. We described one form of this in the Health Care Nation scenario, with an increasing amount of academia involved in the broader medial world. An alternative is possible, whereby allied health retreats as a giant influence. Automation may ultimately increase efficiencies and reduce costs. The Affordable Care Act may succeed in bending down the cost curve, especially if more states participate. A left-liberal drive aimed at providing Medicare for all could succeed, once younger generations supplant their elders in polling and donation. I can imagine an Ocasio-Cortez administration successfully implementing national health care, or shepherding through a set of medical practices that actually reduces costs. A small cultural revolution in favor of preventive medicine that reduces our demand on high-impact health services could happen without governmental intervention, perhaps following on our contemporary evidence-based medicine movement. And we should not rule out further revolutions in medical treatment that improve lives while reducing costs. The point is: educators should envision some end point to their health care expansion strategy.

All these forces could exert powerful influences on American colleges and universities, but we are not entirely passive. We can also transform ourselves. Academia is the repository of many brilliant minds equipped with well-trained imaginations. While academia is at times conservative, and we should expect a drive to keep as much of it intact as possible through midcentury challenges, the sector is capable of generating new forms. Consider how the second half of the twentieth century saw the massive invention of community colleges, federal guarantees for student loans, the development of many new academic fields, the switch of the majority of the professoriate from tenure-track to contingent faculty, the emergence of a nationwide student movement, the creation and rise of online learning, the expansion of degrees and careers to women and underrepresented minorities, and the transformation of *in loco parentis*, among others.

Consider how the first two decades of the twenty-first century brought still more innovations to higher ed: blended learning, a federally led campaign against sexual assault and harassment, a major expansion and contraction of for-profit institutions, the first appearance of AI-backed tutors and campus guides, 3D printing across the curriculum, both augmented and virtual reality for learning, and microcredentials. We should therefore be open to many academic possibilities.

We can imagine a campus where half of the faculty—both researching and teaching—are software. Another institution may exist wholly in two modes unfamiliar to previous generations: mostly online instruction with a distributed, worldwide team of part-time staff to help organize face-to-face events. One state system may collapse into a single campus, dwarfed by its online student body. Students may take classes from three institutions simultaneously, appearing in person only through telepresence robots, building up their academic record through a blockchain-backed evidentiary database, narrated on demand by AI. Student movements may cross campus and national boundaries, forming new social and political constellations. New fields and careers could emerge: AI ethics, digital storyteller management, climate change mitigation administration, gerontology automation. Students who create compelling mixed-reality games may become superstars. Faculty could become cyborgs on multiple levels.

At this point we must reluctantly step away from 2050 and return to the present. How to integrate these wild imaginings and forecasts into the work of today's institutions is the subject of our next and final chapter.

15 Back to the Present

After spending so much time in the future, we must return to the present. This chapter is a transition zone, a kind of airlock between a strange environment and the one we're accustomed to. Here we explore how to connect the previous chapters' ideas to the lived work and experience of contemporary colleges and universities. Put another way, we answer the question, How do we get there from here?

The previous chapters laid out many present-day trends, identifying them as drivers of potential change. From demographics to macroeconomics, 3D printing to automation, the flipped classroom to shifting enrollment patterns, we considered how these forces and ideas might play out over the next decade. Next, a subset of these trends served to inspire a group of scenarios, each taking a deeper look into possible universities to come. We then advanced our vision toward the middle of the twenty-first century, extrapolating with greater imagination, seeking the contours of higher education's next generation and beyond.

Frankly, many of these trends describe a challenging if not dark near- and medium-term future for American higher education. Two great forces, demographic changes and economic transformation, are starting to exert powerful pressures on many colleges and universities. Widespread anxiety about the cost of higher education, particularly in the form of student loans, has combined with partisan politics to lower academia's reputation. Cuts, mergers, and queen sacrifices

outline at best an economic sector undergoing a painful market correction, and experiencing a contraction or bubble at worst. Meanwhile, while offering new ways of teaching and accessing information, the digital revolution also presents threats to traditional higher education in the forms of increased campus costs, online alternatives competing with bricks-and-mortar campuses, and rapid-fire changes to the labor market for which we prepare our students. Much of American higher education now faces a stark choice: commit to experimental adaptation and institutional transformation, often at serious human and financial costs, or face a painful decline into an unwelcoming century.

How can colleges and universities best respond? How can they take advantage of these forecasts and potential futures?

These are not a new questions, nor are they unaddressed by American academia. One unusual advantage of my professional work is that I get to connect with hundreds of institutions, from small rural colleges to multicampus state university systems, professional associations to government agencies. I learn how they plan for the future: which methods and strategies they employ, which offices are involved, and which programs are in play. I've also observed how institutions in other sectors—health care, governments, high technology, the arts—structure their own forecasting strategies. In this chapter I offer findings from this research, integrated with practices in the futuring profession and developments in the digital world.

One popular forecasting strategy involves relying on professional associations and related entities that publish research, often within a networked framework. The Online Computer Library Center (OCLC) and the Association of Research Libraries (ARL) each published environmental scans that identified major trends reshaping the library world, including technological, economic, and institutional drivers.[1] The late New Media Consortium (NMC) created a series of Horizon Reports, documents that used a modified Delphi method to produce forecasts for technology and education within a five-year

horizon. Each Horizon Report addressed a certain domain, from higher education to education in a given region. Dozens of experts from around the world were involved in the composition of each report, using networked technologies (wikis, Web-based polling tools, etc.) to connect with each other productively. Through a series of structured conversations, exercises, and voting by each report's organizers, each report's advisory board generated ideas, trends, and challenges, then whittled them down into the ones collectively deemed most likely to have the biggest impact. After the NMC closed up, the EDUCAUSE group recently acquired the Horizon intellectual property and have commenced developing their own reports.[2] These and other forecasting efforts help colleges and universities envision likely futures.

Perhaps the most popularly described approach to the future I hear from American colleges and universities involves ad hoc intelligence gathering from a combination of sources. Popular futurists, especially those working in technology, such as Michio Kaku (City College of New York and CUNY Graduate Center) and Yuval Noah Harari (Hebrew University of Jerusalem), receive some attention, as do future-oriented publications like *Wired* magazine. Some academics report gleaning futures content from more traditional and familiar sources, including National Public Radio and the *New York Times*. Campus representatives cite a colleague—librarian, faculty member, or technologist—who tends to be especially, even enthusiastically forward looking. Others describe tracking the behavior of traditional-age undergraduates, teens, and younger children as a glimpse of attitudes to come. Professional societies play a role both in terms of their bulletins (which can indicate how a discipline or profession anticipates its own future) and their meetings (which can involve presentations on emerging trends). Faculty and staff have been known to use various social media platforms to follow interesting researchers, while sharing their own questions and discoveries. In one case I consulted with the president of a small college who assigned faculty

members to write brief accounts of what they thought their campus could look like in thirty years, then had the professors discuss their visions with college trustees in a small group setting.

At the same time as such information, inter- or noninstitutional efforts proceed, and individual campuses sometimes conduct their own forecasting work in more systematic forms. A number of academic libraries now employ emerging technology librarians as a job title, for example, Ken Fujiuchi at Buffalo State. Such experts conduct and share forecasting work with an eye on information (and) technology for library needs.[3] Many of the campus technology offices I have worked with perform some kind of futures study, be it through irregular environmental scanning, sharing future-oriented documents internally, or hosting occasional meetings about emerging technologies and pedagogies. Truman State University stands out by establishing a more systematic program led by their chief information officer. Weekly meetings include a "chin-up" component whereby staff are encouraged to think beyond day-to-day operations. Staff discussions follow the release and reading of major publications, like the Horizon Report. Environmental scanning occurs continuously, as individual staff members take time to research and present on certain emerging topics keyed to their own practice and interests.[4]

These are all institutional and human-oriented approaches to apprehending the future. Readers should not be surprised at this point to learn that there are projects to automate forecasting work to different degrees. Prediction markets, multiplayer games designed to crowdsource futuring work since the 1960s, moved online over the past decade. These games allow players to buy and sell shares in potential events, forming a kind of continuous, gamified survey.[5] The Shaping Tomorrow project goes still further, running artificial-intelligence-backed software over the open Web, searching for signals of emerging trends while also collating predictions. In a related effort, Elder Research uses machine learning to collect data and generate

forecasts.[6] It seems likely that some academic group will apply automation to forecasting academia's future.

* * *

At this point the reader might object. "Yes, those are interesting *methods* for a given institution to pursue in thinking about the future, but what practical steps can my campus take? Which paths should we pursue? What should we actually *do*?" That's a fair charge. The complexity and attractiveness of various futures can lead us from considering how we might reach them, or avoid them. We can drive the results of futures work into the present through a form of gap analysis, when an institution seeks to determine the best paths between a present situation and a selected future.

Many strategies for forming those paths are currently being discussed, implemented, or both. This time of institutional challenge has elicited a burst of creative ideas across all sectors of American higher education, as we have seen throughout this book. The remainder of this chapter surveys their respective advantages and disadvantages. Technology plays a significant role in many of these.

Although common themes and problems stretch across American higher education, each institution has distinct characteristics. Generalizing from one subset of the postsecondary sector to others risks imprecision. A regionally serving college in the Midwest or Northeast, where teenage populations are dropping, faces a different situation than one in relatively youth-rich Texas. An elite liberal arts college may well proceed without too many reactions to today's dangers, secure in their reputation, endowment, and small size, while a lower-ranked state university possesses none of these advantages. State governments and trustees often exhibit similar behaviors, but they can also differ in critical ways.

Curricular reformation is one of the leading strategies in play as of this writing. As noted in chapter 4, a growing number of institutions are rearranging their course offerings to attract more students. Generally this entails adding new programs in appealing areas: cybersecurity,

the full range of allied health, forensics, computer science as a whole, computer gaming, digital media, and many STEM fields. These can be minors, majors, and graduate degrees; introducing them can inflect the general core curriculum as well. For institutions not enjoying enrollment booms or massive endowments, this approach also tends to involve subjecting less popular fields to hard examination and, often, defunding. Academic program prioritization processes are often involved to varying degrees of transparency, faculty participation, and length of time.[7] Enough curricular change can alter the nature of a campus, shifting its identity or reputation from one path to another.

The expansive aspect to curricular reformation fits into the long history of university development, as over centuries, campuses responded to emerging fields of inquiry. It also makes business sense for the supermajority of institutions that depend primarily on tuition for fiscal survival. Curricular reform does run several risks. First, launching a new program or expanding an existing one is no guarantee of success. A poorly crafted program or one that fails to connect with students can backfire.[8] Second, student demand can shift and leave a program stranded. Recent interest in forensics, for instance, may be driven by popular entertainment; should that theme decline, so may student interest. Third, too many institutions offering the same major could glut the market and leave departments overbuilt. Meanwhile, the contractive aspect to curricular reform presents real costs, starting with the human damage of unemployment and stymied careers. Some critics argue that colleges and universities have an obligation to knowledge and to future students in maintaining academic units that currently experience enrollment downturns; campuses are not businesses per se, and they should take some steps that do not immediately yield financial benefits. While the German language might not win many students in a time marked by declining interest in foreign languages and the improvement of translation software, offering programs in foreign languages is important for a serious institution, and demand for such study may circle back in years to come.

Putting a campus on a curricular reform footing may present a serious challenge. Given the depth and likely persistence of current transformational trends, campus leaders would likely have to return to these strategic questions frequently, leading to a continuous program review process. Community colleges may lead the way here, already being so closely attuned to local marketplace needs. At the same time, such continuous change would add further pressure to shift the faculty away from tenure-track positions, given the far greater class staffing flexibility offered by adjuncts. Faculty morale could suffer, or at least endure a cultural shift, for professors unused to high stakes and ongoing competition for student interest. Departments might reorganize into new lines or more fluids forms, as we have already seen with Arizona State University. Moreover, an institution will need to expand—or, in some cases, develop for the first time—a strategic intelligence capacity in order to get the best information about student interest and labor market shifts.

Another way to enhance an institution's curriculum is through technology-enabled, intercampus teaching. One of the earliest—and still thriving—instances of this strategy is the Sunoikisis project. Sometimes dubbed "a virtual classical studies department," the Sunoikisis collaborative allows classics faculty at small colleges teach classes on other participating campuses. For example, two professors at two colleges could team-teach a Roman history seminar, with the Republican period specialist taking the lead for the class's first half, then the Roman Empire specialist leading the second. For another example, Sunoikisis facilitated a partially online archaeological course. Students at individual campuses took an online methods class together, then journeyed—physically—to a Turkish dig to meet in person and work on the site. This project might not have been justifiable for a single campus, especially a small one, but became both feasible and rewarding through intercampus collaboration. Similarly, a Michigan consortium now lets faculty teach classes between colleges, starting with one on digital media studies. For several years the Council for Independent Colleges has hosted collaboratives between doz-

ens of colleges and universities wherein faculty teach upper-level humanities seminars in their specialties, expanding the curricular opportunities of each school while enabling professors to focus on areas of interest otherwise potentially too small to justify offering.

In a personal example, in 1999 and 2001, I co-caught such a class on the American War in Vietnam. During the first instance I led a literature class at Centenary College of Louisiana, while a political economist taught his at Rollins College in Florida, and a Southeast Asian historian led his at the University of Richmond in Virginia. Each of these classes met in person in traditional classrooms; between class sessions we connected the three classes using a range of technology, including videoconferencing, email, Web forms and content, and even an experimental peer-to-peer application. We developed a synthetic syllabus that blended all three disciplines, while allowing periodic shifts to discipline-specific work; while each class met at different days of the week and at different times (across two time zones), each week saw us covering the same materials. Partway through the term, a political simulation game explored the Johnson administration's decision-making process over a week of real time, with teams consisting of one or more students from both campuses, each representing a major decision-maker in the process, from the American commander in Vietnam to the North Vietnamese leadership. In 1999 and 2001 we successfully formed a kind of meta-class through continuous conversations, arguments, group projects, and teamwork. The online and analog worlds blended most productively. It was one of the best teaching experiences of my career.[9]

Intercampus teaching lets institutions expand student access to curriculum—not just knowledge, but learning in the company of students and a professional instructor, vetted through the participation of a peer college or university. Students and faculty gain access to a larger and potentially more diverse student body. The institution may develop greater capacity and skill in computer-mediated teaching and learning, while professional development opportunities open up for faculty and support staff. This is not easy work to set up, as it requires

significant preparation and multiple levels of collaboration (involving faculty members, academic deans, registrars, curricular committees, and campus technologists at a minimum), but the rewards are now known.

A different curricular approach engages technology more extensively. Beyond expanding relevant departments (I mentioned computer science and digital media studies above) and generally making blended and wholly online learning available, computing can play other roles on campus. A long-standing pedagogy dating back to Seymour Papert's work asks students to create with digital tools, learning by exploring their affordances. This constructivist approach sees students building robots, writing code, or making digital media in ways that develop their expressive talents and help them approach curricula from new angles. Digital storytelling is one example of this computer-mediated learning approach. Examples can be found from primary school through postsecondary education.[10] We are also seeing bursts of creativity through the maker movement, as well as the first steps of thoughtful creation in augmented, virtual, and mixed realities. The digital humanities implemented with student involvement can exemplify this trend, as when students use digital tools to conduct research into humanities questions while producing a digital product. Small colleges' recent exploration into what some call the digital liberal arts offers another example of this approach. A related strategy teaches students computer coding as a cross between a new literacy and a foreign language. Some campuses have explored allowing students to learn PHP or Python instead of a foreign language. The reasoning is that coding plays such a deep role in our society that students need to have a sense of its distinct logics in order to become informed citizens. Additionally, computational thinking is different enough from other forms of cognition that it requires curricular space. Taken together, these forms of deeper technological engagement can give students important skills while distinguishing a campus from competitors.

Such strategies are largely internal ones. They draw on preexisting resources: faculty (mostly) and staff already hired, technological infrastructure generally in place. The concepts do not require licensing, as they are known and described in accessible literature. Yet the stresses on higher education can be drastic and require responses at a larger scale.

If economic stratification continues to rise and shape society, driving what one observer refers to as "the big sort," whereby financial differences create or expand class gaps from school funding to career options to population settlement, then higher education faces strategic choices starting with recruiting and career placement. Elite colleges and universities could embrace their role in reproducing families of privilege by emphasizing the value of admissions exclusivity, assortive mating among the enrolled student body, and lifelong networking with the upper 1 to 5 percent. Certain programs within institutions that are not necessarily elite could make such a pitch for their particular offerings. In contrast, other institutions may emphasize a social justice mission, focusing on elevating the lives of the poor, the working class, and economically marginalized nonwhite populations. They will therefore have to develop business models that sustain this approach.[11]

Some campuses may opt to follow the classic mid-twentieth-century strategy of teaching students into middle-class careers. The viability of applying this strategy depends in part on how Americans see the viability of the middle class—that is, if the middle class shrinks, so does the space for this strategy to succeed. It also depends on successfully aligning incoming students, curriculum, and postdegree job placement, which is by no means an assured achievement for all interested campuses. One illustrative anecdote: a public university president approached me after I led a short workshop on emerging trends in higher education to talk about job prospects for graduates. He explained his problem. Previously the university took the children of working-class parents and gave them an education that equipped

them for middle management positions, often in the same industry where their parents worked. But the campus stood in a Rust Belt region, where those industries exited in the 1990s, having been moved abroad to lower-wage nations. No major new economic enterprises replaced them. "So what careers are you preparing your students for now?" I asked. "I honestly do not know," was the university president's reply.

Another strategic option is launching a strategic investment to significantly improve teaching. This can include traditional elements—such as expanding professional development, creating faculty teaching centers, and supporting the scholarship of teaching—but can also go further still. For example, blended learning often yields better results than either wholly online or entirely face-to-face teaching, and an institution can commit to doing this at scale. Costs can build up depending on the nature of a school's preexisting media production capacity and how extensive that production becomes, alongside the question of professional support for many faculty members rethinking and assessing pedagogy.

A related approach involves carefully assembling and analyzing the growing amount of data generated by students as they interact with a college or university, generating in turn information for faculty and staff to use in deciding how best to support learners (as discussed in chap. 5). The potential for improving student experience and outcomes is significant, and an institution can turn this to its advantage in attracting more learners. Related to data analytics is increased personalization, shaping learning structures and content to best assist individual students as they navigate a curriculum. Both personalization and data analytics can be taken further through automation, which has the potential to make these processes both more efficient and cost-effective. AI can, in theory, automate other student-facing functions, from providing official information about campus functions to assisting in class discussions. Taken together, a broad-ranging institutional investment in improving student learning may yield a campus a clear strategic advantage.

A third approach to strategically improving teaching and learning involves taking new findings about the science of learning seriously. Since the late 1990s, a quiet renaissance has occurred as multiple researchers have used new methods and tools, including fMRI scanners, to better understand how the brain learns. Publications have streamed forth in peer-reviewed scholarly journals and a growing number of monographs and popular press books, but their findings do not appear to be generally heeded. A campus might make a strategic decision to explore this new research and apply it throughout the curriculum. Professional development, faculty scholarship on teaching, and faculty support centers could be funded to drive such changes. Hiring, tenure, and promotion bodies could consider science in their proceedings. Institutional research and allied offices might explore ways by which student learning improved. External bodies, such as professional associations or certification boards, could publish assessments of a given institution's progress toward incorporating the new science of learning, potentially through a public label akin to LEED certification.

Such advantages are needed for a field suffering the demographic pressures outlined in chapter 2. In particular they point to a major crisis unfolding for institutions serving traditional-age students, as that population plateaus or declines, especially after the mid-2020s birth dearth really takes hold. The crisis worsens and spreads when we consider the political stress on recruiting international students. In response, campuses have several strategic options for regrowing a student population. One is to defy politics and more aggressively recruit international students. International recruitment always bears extra costs, especially when a campus introduces itself to a new nation or region, but they may be viewed as a good investment, given the continued high reputation of American colleges and universities. Research-oriented institutions can help faculty work with scholars worldwide, and also introduce students to international research—both processes enabled by increasing use and power of networked technology. The difficulties of navigating an anti-international federal

administration, not to mention the many dynamics of international relations (see chap. 14 for a sketch) will add to the difficulties of this approach.

One way to mitigate these various costs is for an institution to expand its online classes and market them globally. A student in Pakistan or Indonesia may find attending classes in the United States to be a terrifying prospect because of the specter of violence, so taking those classes online from home in relative safety may be more appealing. Similarly, the multiple frictions of visas, security, and physical travel can be reduced by entirely online classes. There are precedents for this, not least through massive open online courses (MOOCs), which have always appealed to global audiences. Steadily improving technological access and infrastructure yields a growing potential student body.

Expanding a school's online class presence has been a strategy since the 1990s. Traditional campuses like Florida State University, the Berklee College of Music, and Southern New Hampshire University developed larger classes online than in their bricks-and-mortar classrooms. Online classes let a campus overcome local challenges, such as undersupported physical infrastructure or an unpopular location. They fit more effectively into the schedules of working students.

What we used to call distance learning also speaks to people to the population older than twenty-two, for whom a residential experience has little appeal, and it is more convenient than commuting. As the American population ages, colleges and universities with missions to serve their state or region may increase the proportion of adult learners in their student bodies at both undergraduate and graduate levels. Community colleges already do this effectively, and now the rest of higher education may apply those lessons to their own practice. I expect to see more programs deliberately recruiting seniors as that population grows. Some will have new reserves of free time and curiosity to gratify. The idea that continuing learning can decrease the likelihood of dementia may prove a fruitful connection

between elders and campuses. At least one college president has publicly recommended that institutions market themselves to senior citizens.[12] Additionally, the increasing rates of financial stress suffered by people who plan to retire may lead that population to take classes for professional purposes. How such a strategy would best be realized remains to be seen. Perhaps students interact with colleges and universities in intervals throughout their lives, both online and offline, in learning episodes or stages. Perhaps we should speak not of a four-year undergraduate experience but of a sixty-year curriculum, and give new meaning to "lifelong learning."[13]

So far all of these strategies involve seeking to expand the size of an institution's student body. An alternative approach would be to deliberately *reduce* numbers and reorganize to serve that new population. Saint Michael's College in Vermont made such a decision in 2013–14, with the idea that they would "right-size" operations: "President John J. Neuhauser, a former business school dean at Boston College, said Saint Michael's is preparing for its enrollment to drop from 1,900 now to 1,600 in the next several years. In turn, the college plans to cut the number of faculty positions from 150 to 135, mainly through attrition."[14]

Such a new arrangement might reduce class sizes, attracting many. It can also result in greater attention to individual students. Overall, this can be seen as a way of focusing on quality rather than quantity, embracing rather than resisting demographic destiny.

In addition to seeking to expand the student body (or to shrink it carefully) there are financial paths forward for colleges trying to anticipate future developments. There have been many calls for state governments to reverse their defunding course and return to midcentury public higher education funding levels. Chris Newfield offers the most ambitious and culturally situated such call, urging America as a whole to rethink our understanding of higher education as a private good. Instead we should reestablish it as a public good, whereby public (i.e., state governmental) funding leads to communal benefits. Newfield is optimistic about the possibilities of such a transformation:

"in 2015, the country finally hit a milestone that might be like those that were on the road to Medicare, which established the public good principle of full health care coverage in retirement, which then made meaningful coverage the responsibility of public funding. The conceptual and ethical arguments for public good funding are being rebuilt. They are converging. And their political costs are coming down."[15]

In the years since *The Great Mistake*'s publication, some further evidence for such a cultural transvaluation has appeared. The 2016 Bernie Sanders presidential primary campaign revealed significant appetite for expanding public support for a variety of causes, including higher education. Signal congressional victories in 2018's primaries and elections similarly demonstrated a resurgent political left. We could well be witnessing a rising curve of a cultural shift, the peak of which might yield a return to public support for public higher education.

But this aspiration may run hard against present-day politics. The reconsideration of public higher education as a private good came about during a tectonic shift in American political thought, away from the New Deal/Great Society midcentury settlement of an expanded public sector, and toward a more market-oriented, privatizing-interested approach frequently termed neoliberalism. This sense of the world as best understood through a market lens, saturated with competition and whereby meaning can be increasingly assessed through price, is deeply laid and not easily set aside. We have seen this worldview at work in many discussions of higher education strategy, as campus leaders strive to improve their institution's bottom line, as students shift enrollment patterns based on perceived likelihood of employment return, and as income-based repayment plans offer to support remunerative majors and not those less likely to turn a profit. Terms and practices are imported from the business sector: key performance indicators, project management, return on investment, disruptive innovation.

Moreover, the arena of state politics does not appear friendly to a Newfieldian revolution. All fifty states have their own individual is-

sues and political contours, but there are some general patterns. State legislators weigh competing constituencies in setting budgets, and higher education is, simply put, often out-competed. Medicare and Medicaid are both costly and highly valued by many. While state health care funding expanded unevenly across the nation, the Affordable Care Act was revealed to be quite popular in 2017, when the Republican-majority Congress sought to repeal it. We should bear in mind seniors, who are the leading consumers of state-supported medical care and are more likely than other populations to vote and donate to political campaigns. In addition, state legislators are often firmly committed to maintaining funding for penal systems, at times because of local politics (such as California's strong prison guard union), otherwise in response to popular fears of crime. One Californian attempt to cut prison expenses backfired, suggesting that education remains easier to cut.[16] Beyond policing and health care, many states now struggle to maintain funding for public pensions. Depending on the state, such funding may have been stressed by tax cuts, budget cuts, or lower-than-expected investment returns. Some states, such as Illinois, are legally bound to maintain pension funding, while others see political struggles over pension reform, that is, cuts to either present-day payments or to future retirees' support. Pensions and health care costs are likely to rise in states with aging populations, as noted in chapter 3. Finally, some states see still further competition for state funding in the form of local projects and concerns, like road repair in cold areas or environmental damage costs in coastal regions. Taken together, state colleges and universities that are seeking more funding face fierce competition. Unless state tax revenues enjoy a major rise, as North Dakota did with taxes on new oil income, the odds are not favorable for public re-funding of higher education.

The quest to add funds to public higher education also runs into another problem: rising public antipathy toward colleges and universities in general. Recent surveys have shown growing numbers of Americans expressing concern, anxiety, and outright dislike of higher

education.[17] The causes are diverse and much discussed: high-profile free speech incidents from Middlebury to Stanford; media coverage of leftwing faculty members; dislike of certain courses of study; anxiety over student debt and rising tuition. While these negative attitudes are especially prominent among Republicans, a fair number of Democrats share similar views. This reputational problem could affect all of higher education, private as well as public, if wealthier individuals are less inclined to donate to campuses and more interested in supporting politicians who would prefer to cut academic support from state universities and federal research grants.

One way to address this problem is for academia to generate and support more public intellectuals. High-profile figures from Noam Chomsky to Carl Sagan have historically intervened in public debates and sought to educate society as a whole. They often successfully combine their scholarly roles with media savvy, appearing in newspapers, magazines, mass market books, and television. The digital revolution empowered many faculty to take up such roles through blogs, podcasts, Twitter, and YouTube. Current examples include Siva Vaidhyanathan (University of Virginia), Zeynep Tufekci (University of North Carolina; Berkman Klein Center for Internet and Society at Harvard University), and Tressie McMillan Cottom (Virginia Commonwealth University), all of whom actively use Twitter and other digital platforms. To them we can add today's most popular public scientific figure, Neil deGrasse Tyson, based not on a campus but in an allied cultural heritage institution, the Hayden Planetarium. He combines old media (television, print books) with the new (Twitter, a podcast, YouTube). The work of such figures benefits academia immensely, showing faculty members to be engaged with today's problems, fruitfully using their training and research, and crossing over any perceived Ivory Tower or elitist barriers. Campuses could encourage and support their faculty members in doing public intellectual work at typically little cost, winning reputational benefits for themselves and for higher education as a whole in return. This practice

may be of particular benefit to academic fields facing enrollment problems, especially the humanities.

The obverse of the revenue change coin involves controlling and cutting institutional costs, which we have already observed as going on in many colleges and universities, especially since the 2008 financial crisis. Such strategies have obvious business appeal, which is heightened by the many pressures this book has articulated. Depending on the institution, there may well be room for further cuts: shifting faculty lines from tenure-track to adjunct status; outsourcing campus services, from security to IT; automating functions hitherto performed by human beings. Professional development support, work hours, certain staff positions, and compensation to senior administrators can all be reduced, depending on local conditions. Underperforming academic units can be trimmed or shut down completely. Campus spaces can be rented to appropriate parties, such as leasing classroom space for a clinic's professional development needs. Certain items can be sold, like valuable art collections or land parcels.

Technology could play a role in such cuts. It is unusual to think of campus technology in terms of cost savings, since IT usually represents significant costs for an institution's budget, from supporting a wide range of classroom technology to enterprise software systems, but emerging technology offers campus planners several options. One is to create a largely online program with lower tuition, along the lines of Georgia Tech's MOOC-based computer science master's degree. The attractiveness of lower cost could bring in more students. Another is to automate campus functions, from answering student questions about business operations to serving as a teaching assistant. The latter can take the form of a writing aid, such as Turnitin's Revision Assistant, or even as class content provider, as with Duolingo's language learning app. At present these are still nascent tools, best used alongside a human instructor, but one can imagine cases when, as the technology develops, a campus leader decides to automate for lower costs. Finally there is the possibility of outsourcing

certain classes to other universities or to third-party providers who make class materials available digitally.

Beyond cuts, a campus can take more drastic steps. As we saw in chapters 2 and 6, an institution can close a school it owns, such as a graduate school or a specialized undergraduate subdivision. It can seek to merge with others that are geographically close or similar in mission, a process that ultimately entails cuts as redundancies appear within the combined entity. An authorizing body might suggest a merger with some measure of compulsion, as with multiple campuses within a state system or several colleges operated by the same religious body. After such cuts and fusions, some measure of the original institution—its mission, its history, some of its people—is preserved, ideally. Put one way, these are sacrificial strategies, costly yet aimed at saving something from what could well be a catastrophe.

* * *

This chapter sketches some ways campuses can start strategically anticipating their futures. The list is by no means exclusive. Certain methods and practices expand an institution's ability to see the forces shaping possible future situations, while a growing body of innovative responses demonstrate higher education's ability to rethink its present-day structures. We can envision different worlds and work toward the better ones.

The key to this strategic thinking is not technological skill nor administrative efficiency. Instead, higher education's future lies in the exercise of the human imagination. It can be difficult to think forward to a time when a campus, its various populations of students and staff, its contextual economy, the surrounding geopolitics all change. Faculty and staff are often immersed in the daily operations of teaching, support, service, and research. The many stresses pressing against higher education described in this book force us to pay ever closer attention to those immediate details, and can dissuade us from raising our heads out of the trenches to look ahead. Yet the

world refuses to respect our quotidian insistence, and persists in throwing trend after trend against our classrooms, libraries, assumptions, and general populations.

Only by growing the capacity to look ahead can we effectively meet these challenges. A degree of empathy is essential as we try to imagine a student body quite different, perhaps, from the one we belonged to in our undergraduate days, and one increasingly burdened with debt. Science fiction can help us imagine what a continuous torrent of technologies could bring about, and how societies can transform over time. The historical imagination, the kind of thinking that lets us grasp other places and times, as well as the sort that suggests lessons for the present and future, is essential.

I think academics can excel at developing this forward looking imagination, since it embodies so much of what we value. It is a form of learning about the world, of expanding the ways we can see. The imagination is deeply personal, an expression of our deep subjectivity, of our selves. It is also intersubjective, drawing on the many ways humans live together—again, a form of being that we seek to inculcate in our students. The imagination can be playful, inspired by creativity and a sense of openness to possibility—not always the most comfortable stance, but definitely a productive and rewarding one.

I am reminded of that rare and precious experience we support in college classes, both in person and online. It's that moment of insight, when a student suddenly grasps a concept and sees the world as larger and stranger than it was just a moment previously. We build that moment through a complex mechanism of instructors across disciplines, combining their research and pedagogy, admissions offices bringing students there, support staff from librarians to advisors and technologists keeping the whole system operating, and senior administrators tending the entire apparatus. That moment is, in many ways, what higher education is about. It's what the enterprise is for. Can we turn that mechanism on ourselves, to build up a way of learning and understanding the fate of colleges and universities?

As we peer over the horizon, our vision powered by imagination, our capacities drawing on learning from across the curriculum, our empathy fired by care and excitement, the conclusion is inescapable. What could be a more appropriate way to rethink higher education?

Notes

Introduction

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Chapter 5. Beyond the Virtual Learning Environment

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